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EASY WAY TO EVALUATE LMSs (EW-LMS)

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ABSTRACT

Easy Way to Evaluate LMSs (EW-LMS)

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E-learning systems have become an issue in recent years. However the instructor is a very important factor in the learning process, but the advantages of e-learning systems change the role which the instructor plays in this process. This thesis is about developing a computer program in order to evaluate the learning management systems (LMS). The developed system is web-based and can easily be used over the internet any where over the world at any time. This will provide with a web-based decision support system (DSS) that may help the users to choose the convenient system depending on their needs and their type of usage. This evaluation system was designed by using the MS-Visual Studio .NET and its database was designed by using MS-SQL Server.

In order to evaluate the LMSs, we must consider the most important features of any LMS and put them as the criteria that may enable us to evaluate the systems. In this study, fifty two comprehensive features of any e-learning system are presented. The user can select his group of features from the list of 52 commonly used features. The system can then find the best LMS to match the selection criteria. The system's database contains a full description on the most famous LMSs over the web and the widely-used over the world. These systems are: Moodle, ATutor, Blackboard, WebCT, and Claroline. Each one is analyzed as stated in the list of features.

This thesis is oriented to any one interested in the e-learning field and its evaluation. The individuals who are usually concerned with this project are

teachers, students, and any educational organizations such as: universities, schools, institutes, and anyone who seeks to have a LMS.

Keywords: E-Learning, Learning Management System (LMS), Course Management System (CMS), Decision Making Process, Evaluation for LMSs, Comparing LMSs.

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LIST OF ABBREVIATIONS

ACLT	Advanced Collaborative Learning Tool
ADL	Advanced Distributed Learning
ADO	ActiveX Data Objects
AI	Artificial Intelligence
ASP	Active Server Pages
CAS	Central Authentication Service
CASE	Computer Aided Software Engineering
CE	Campus Edition
CIPD	Charted Institute of Personnel Development
CIS	Computer Information Systems
CMS	Course Management System
COL	Commonwealth of Learning
COTS	Commercial Off-the-Shelf
CPU	Control Processing Unit
DFD	Data Flow Diagram
DSS	Decision Support System
EduTools	Education Tools
E-Learning	Electronic Learning
ER-D	Entity Relationship Diagram
E-World	Electronic World
FTE	Full-time Equivalent
GOTS	Government Off-the-Shelf
GUI	Graphical User Interface
HTML	Hypertext Markup Language
IE	Internet Explorer
IEEE	Institute of Electrical and Electronics Engineers
IMAP	Internet Message Access Protocol
IMS	Instructional Management Systems
IP	Internet Protocol
IRC	Internet Relay Chat

IS	Information Management System
ITS	Intelligent Tutoring Systems
	Information Technology Support
JAD	Joint Application Design
LAMP	Linux, Apache, MySQL, and PHP
LCMS	Learning Content Management System
LDAP	Lightweight Directory Access Protocol
LMS	Learning Management System
MAUT	Multi-attribute Utility Theory
MS	Microsoft
MySQL	My Structured Query Language
NEU	Near East University
NNTP	Net News Transfer Protocol
OpenUSS	Open University Support System
OS	Operating System
OSS	Open Source Software
PHP	Hypertext Preprocessor
POP3	Post Office Protocol
Q&A	Question and Answer
QWS	Qualitative Weight and Sum
RAM	Random Access Memory
SCLT	Standard Collaborative Learning Tool
SCORM	Shareable Content Object Reference Model
SDLC	System Development Life Cycle
SMTP	Simple Mail Transfer Protocol
SOAP	Simple Object Access Protocol
SQL	Structured Query Language
SSL	Secure Sockets Layer protocol
TEx Sys's	Tutor-Expert Systems
UBC	University of British Columbia
ULT	Universal Learning Technology
UML	Unified Modeling Language
VB	Visual Basic
VS	Visual Studio

VLE	Virtual Learning Environment
WCET	Western Cooperative for Educational Telecommunications
XML	Extensible Markup Language

Chapter 1

INTRODUCTION

One of the most confusing aspects of e-learning is that nobody knows what it is. Most of us know the "E" stands for "Electronic". But the "E" in E-Learning would be better defined as Evolving or Everywhere or Enhanced or Extended (http://www.managersforum.com/eLearning/). In general, there is no universally accepted definition of e-learning, but the following is used by the Charted Institute of Personnel and Development (CIPD): "*Learning that is delivered, enabled, or mediated using electronic technology for the clear purpose of training in organizations*" (http://www.cipd.co.uk/).

Throughout history technological advances in communication have had a lot of developments, for example, the printing press, the telephone, radio, film, television, and more recently the Internet. In education these advances have facilitated the progression from one-to-one tutoring to mass education.

In these days, we can see clearly the rapidly changing and developing in technology. So, some people are going to name this generation as the speed generation or the electronic world (e-world). E-Learning becomes one of the important fields and one of the fastest growing areas of the high technology sector development, especially in the academic environments. It is the newest way for the individuals and organizations to get knowledge and meet their requirements. These requirements are met by electronic learning (e-learning).

E-learning is the delivery of teaching material electronically depending on good standards and quality across the board without the limitation of a specific location. It involves the use of multimedia interaction. This multimedia includes more than one form of media such as text graphics, animation, audio, video and video conferencing.

Knowing a little bit about learning styles can help you determine if online learning is designated to you. The interaction and delivery methods used in online classes are dramatically different from traditional classes, so understanding how you learn is a good part of the decision-making process. Undoubtedly, the knowledge in general can help you improve your study habits and be successful in any educational setting, regardless of what type of learner you are.

1.1 Problem Statement and Motivation

In this thesis, it is focused on the LMSs and CMSs evaluation, assessing them for users; which one is better than others, which one is more usable, and which one is more efficient depending on their needs.

Actually, the electronic learning, as one of the most important fields in information technology, has a lot of development operations. These developments give a huge number of systems which ask to find some serious solutions in order to evaluate these systems. To evaluate any such information system (IS), we firstly should find the major features of this kind of systems and the aim from using it, then we assess if it meets our requirements and services which we need from it.

The operation to assess any information management systems is one of the decision making processes which is a part from the artificial intelligence field in computer sciences. The question that may arise now is: how can I choose a system? The genuine problem will be in: how we can evaluate a group of systems in order to find the suitable one for user, whatever his method of using is.

Every day, the LMSs' developing software companies over the world offer the end-users numerous softwares, web sites, and open source systems. In the light of what stated before, it is noticed that there is a big problem growing up: How we can find out a specific system from this huge number of systems offered.

This problem may generate some more confusing problems. Therefore, this thesis focuses on the LMSs evaluation and assessment and how we can help and support a user who wants to take a decision to choose a LMS whatever he is: a learner, a teacher, or an educational organization.

1.2 Proposed Solution and Methodology

Through this thesis, I will try to find a solution for the problem mentioned in the previous section. This solution should be smart and more efficient than other solutions available over the web. It demands using artificial intelligence methods and decision making procedures to provide a smart process to help users in taking their decision. This kind of artificial intelligence algorithms may depend on fuzzy logic comparisons and structural conditions to find a system from a group of choices as a suitable choice for the user.

Our process will contain some steps; one of them will be for determining your needs for features, another for weighing these features and the last step will show the result and may also show what the other users had chosen before. This process, in general, can be shown clearly in figure 1.1 below.

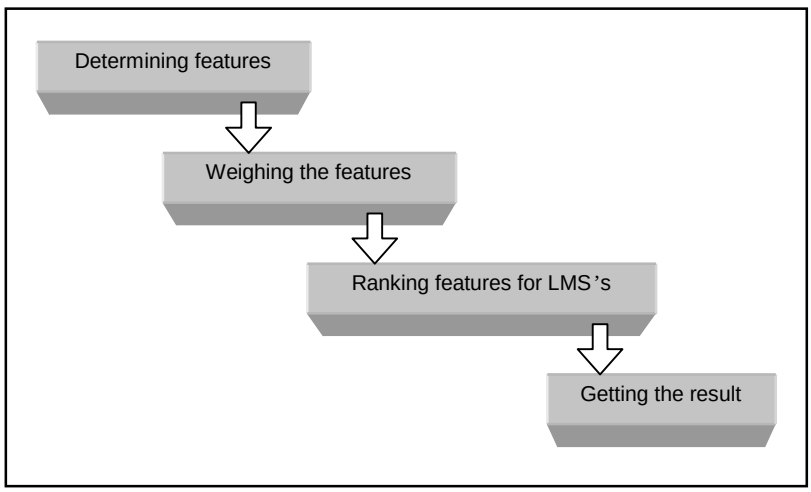

Figure 1.1: The evaluation process-flow graph

1.3 The Goal of This Thesis

This thesis will offer a web-based application to create an evaluation process to LMSs. Our duty here is to develop an intelligent decision making algorithm that will evaluate some LMSs over the web in order to provide a web-based DSS which helps the users to choose the convenient system depending on their needs and their usage.

1.4 Thesis Objectives

The objectives of this thesis are as follows:

1. Introducing the e-learning and the LMSs in general and showing how the internet and web technology help us in getting knowledge quickly.
2. Analyzing LMSs' features and classifying them in groups by using some criteria depending on type of use, number of users, communication media, type of learning, and some others.
3. Simplifying the results of the above-stated analysis and assigning the useful and important features which will be the standard for our study.
4. Defining and developing an intelligent decision making algorithm to evaluate the LMSs.
5. Comparing between LMSs depending on their features by presenting some descriptions for each one for them.
6. Constructing a smart relational database to store all analyzing data in order to return it whenever needed.
7. Designing a web-based evaluation system to test and then to apply the algorithm mentioned before.
8. Developing an automated tool for assessing LMSs depending on previous experiences.
9. Controlling the rapid development in e-learning fields, especially in LMSs' development, by producing some tools to evaluate and insure the quality of them.

1.5 Limitations of this Thesis

This thesis and its web-based project have these following limitations:

1. The research is limited to the users who seek getting a LMS or to any other user interested in the e-learning evaluation field.
2. For evaluating the systems, the total number of LMSs presented through this study is twelve.
3. Evaluating the LMSs depends on a group of criteria called as the features of LMSs. The number of these features is limited to fifty-two.

1.6 Our Research Questions

After completing this thesis, one can easily answer the questions that aim to make the study more understandable and more effective, as well. The questions are:

- What is the e-learning? And what does it benefit us?
- Why are we going to evaluate LMSs?
- How can we control the development in LMSs and insure the quality?
- What are the currently-used methods in evaluating the LMSs?
- What is our new developed algorithm we are going to provide? How does it work? And what does it give more for the evaluation operation?
- Which logical processes and programming controls can we use in developing the evaluation algorithm?
- How can we compare two LMSs or more, with same features, to find the best of them?
- How can we benefit from the previous experiences to improve our evaluation?
- Which web tools will we use in developing the evaluation system?

1.7 Definition of Terms

E-Learning:

The delivery of a learning, training or education program by electronic means. E - learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material (Stockley, 2003).

Learning Management System (LMS):

A learning management system is a software application or Web -based technology used to plan, implement, and assess a specific learning process. Typically, a learning management system provides an instructor with a way to create and deliver content, monitor student participation, and to assess student performance. A LMS may also provide students with the ability to use interactive features such as threaded discussions, video conferencing, and discussion forums. The Advanced Distance Learning (ADL) group, sponsored by the United States Department of Defense, has created a set of specifications called Shareable Content Object Reference Model (SCORM) to encourage the standardization of LMSs (http://www.whatis.com/).

Decision Support System (DSS):

A decision support system is a computer program application that analyzes business data and presents it so that users can make bu siness decisions more easily. It is an "informational application" (to distinguish it from an "operational application" that collects the data in the course of normal business operation). A decision support system may present information graphically and ma y include an expert system or artificial intelligence (AI). It may be aimed at business executives or some other group of knowledge workers (http://www.whatis.com/).

Artificial Intelligence (AI):

Artificial intelligence is the simulation of human intellig ence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using

the rules to reach approximate or definite conclusions), and self-correction. Particular applications of AI include expert systems, speech recognition, and machine vision (http://www.whatis.com/).

Evaluation Process:

Evaluation involves assessing the strengths and weaknesses of programs, policies, personnel, products, and organizations to improve their effectiveness (As defined by the American Evaluation Association).

Open Source Software (OSS):

Open source software refers to software that is developed, tested, or improved through public collaboration and distributed with the idea that they must be shared with others, ensuring an open future collaboration (http://www.whatis.com/).

1.8 Overview of This Thesis

This chapter (chapter 1: Introduction) introduces the thesis subjects in general, the problems we face, the suggested solutions to solve them, and also it displays the aims and objectives included in the thesis.

The following chapters will be more specific and we will go in depth to understand more about what we are going to develop in this thesis. These chapters will contain a full analysis of LMSs' features and full description of our developed algorithm which will evaluate the systems under assessment. In the following, we are over viewing all chapters and appendices included in this thesis:

Chapter 2: It gives some background about the LMSs and some literature review comes out from research operation about the LMSs and the evaluation processes of them. At the end of this chapter, I indicated the results that were got from this research operation.

Chapter 3: This chapter is to represent the methodology which used in the evaluation operation. The developed evaluation algorithm is discussed

here: what it is and how we developed it! I discussed the algorithm from the logical, mathematical, applicable, programmatic, and user vie w points. This chapter also offers a case study for a complete evaluation operation as a sample example.

Chapter 4: This chapter is to analyze the criteria of our study or the features of LMSs. In this chapter, the features (52) have been well-defined and classified into 6 main factors.

Chapter 5: This chapter represents the 12 products out of the 5 LMSs included in this study and also why they have been chosen each one of them.

Chapter 6: This chapter is to document our web-based evaluation system. This documentation contains two main parts: technical documentation and user documentation. The technical documentation is for the analysis and design phases from the system life cycle of the project and the user documentation represents the user guide manual for the administrator and visitor view points.

Chapter 7: This is the conclusion and recommendations' chapter. It denotes the most important findings and results came out of this study and the recommendations that may be advised for such kind of studies in the future.

Appendix A: This appendix shows all the screen shots captured from the evaluation system offered through this thesis to all pages in order to explain them in the user guide in chapter six.

Appendix B: This appendix includes the LMSs featu res' descriptions for all products presented in this study.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The major idea in this thesis is to evaluate the LMSs available over the web for all expected users (learners, teachers, and educational organizati ons) who are looking for a LMS that depends on their needs by using an intelligent decision making algorithm to achieve this evaluation. So, as a first step, we need to make some related researches to see what is new in this field.

2.2 Related Research

The researches and studies mentioned below are arranged by date from the oldest to the newest:

3Waynet Inc. (2003): This study describes the findings of a survey-style evaluation of open source LMSs. The aim of this study is to recommend a LMS which can be implemented by Commonwealth of Learning (COL). This study identifies the criteria which will be useful in evaluating open source LMS's and then it assesses the candidate LMS by using the criteria. Finally, it recommends a LMS for installation and use by COL.

The researchers were using the methodology in evaluating process: (1) develop evaluation criteria, (2) identify open source candidate, (3) filter candidates to produce a short-list, (4) systematic evaluation of features, (5) systematic evaluation of general criteria, and (6) recommendation.

Bednarik (2002): This study aims to develop a model to evaluate educational software with non-professional evaluators. It emphasizes the importance of the role of a peer review in the selection of educational softwa re. The author defined the usability and the human-computer interaction as: "The effectiveness,

efficiency, and satisfaction with which specified users achieve specified goals in particular environment".

He classified the usability to some functions: easy to learn, easy to use, easy to remember, few errors, and subjectivity pleasing. This study offered a usability evaluation method depending on four main features: (1) usability testing, (2) usability inspection, (3) usability inquiry, and (4) modeling and s imulation. It also introduced the most important usability methods.

Catalyst (2003): This study aims to evaluate and select the best open source LMS for development and large-scale deployment as a part of the New Zealand Open Source Virtual Learning Environment Project. The LMSs which were evaluated in this study are: ATutor, Moodle, and Ilias. This study shows that each LMS has same significant differences in their design, architectures, and implementation.

The evaluation methodology used in this study co ntained the following phases:

1. Developing a technical evaluation criteria,
2. Deploying and evaluating,
3. Overall architecture and implementation.

As a result of this study, Moodle was selected as a core LMS for the New Zealand Open Source Virtual Learning Environment Project.

Hall (2003): This study represents the main terms used in evaluating LMSs, which are: high availability, usability, scalability, interoperability, stability and security. Hall defined each term as follows:

- *High availability*: The LMS must be robust enough to serve the diverse needs of thousands of learners, administrators, content builders and instructors simultaneously.
- *Usability*: To support a host of automated and personalized services, such as self-paced and role-specific learning, the access, delivery and presentation of material must be easy-to-use and highly intuitive—like surfing on the Web or shopping on Amazon.com.

- *Scalability*: The infrastructure should be able to expand, or scale, to meet future growth, both in terms of the volume of instruction and the size of the student body.
- *Interoperability*: To support content from different sources and multiple vendors' hardware/software solutions, the LMS should be based on open industry standards for Web deployments (XML or SOAP) and support the major learning standards (AICC, SCORM, IMS and IEEE).
- *Stability*: The LMS infrastructure can reliably and effectively manage a large enterprise implementation running 24x7.
- *Security*: As with any outward-facing collaborative solution, the LMS can selectively limit and control access to online content, resources and back-end functions, both internally and externally, for its diverse user community.

Hanson and Robson (2003): This research describes an evaluation framework for a developed and used decision making system. It aims to deeply analyze the course management technology requirements. It focuses on the gain or loss in learning effectiveness and efficiency and on the total cost of ownership.
"*Evaluating course management technology options challenges higher education decision makers*", they said. They were emphasizing the benefits of the evaluation process, and also assigning values to product, features and costs.

3Waynet Inc. (2004): It is a guide to help users using a software tool for evaluating LMSs which were created and designed by 3Waynet Inc. and licensed to Commonwealth of Learning (COL). This evaluation tool is in spreadsheet format runs by the Microsoft Excel.
This tool contains four sheets, which are: (1) LMS registry, (2) Criteria, (3) Features, and (4) Results. In the first sheet, the user should enter the LMS registry information, and in the next sheets, the user should answer a number of questions related to the evaluation process.
Accordingly, this evaluation process contains the following four general steps:

1. Completing the LMS registry,
2. Completing general criteria,
3. Rate product functionality,
4. Completing results.

These steps require from the user to weigh each criterion depending on his own needs and also weighing the LMS seeking.
This guide contains a full example on how we can use the spreadsheet tool to evaluate LMSs.

An and Restrepo (2004): This study is designed for presenting a national e-learning system in Colombia by Indian support and evaluating this system. This evaluation aimed to include three purposes: (1) to evaluate the service given by the training organizations, (2) to evaluate the follow up process on the training organizations, and (3) to propose corrections in order to guarantee the quality of the service given.
This evaluation methodology has the following phases:

1. Design of simplified model of quality,
2. Identification of information sources,
3. Elaboration and testing of the survey forms,
4. Preparation of aids of the field investigation,
5. Planning the information harvesting activities,
6. Processing the data,
7. Analysis of collected data,
8. Validation and adjustment,
9. Summary of recommendations,
10. Production of the final report and the executive report, and the presentation of both of them.

The result was that the training instructions have been really applied in the project and showed all their determination in achieving the set goals.

Baker (2004): He defined the LMS as: "*LMS is a software database that automates the registration, attendance, and performance record keeping for e-learning (as well as other types of instruction) classes*". This study talks about the LMS market and its growing especially in small business field. It discusses the most costly LMS features that might be less valuable to small companies and also the most important functions and features of them.
Baker (2004) noted that "*small business, generally, will concentrate their resources more on cutting costs and increasing productivity, then they will integrate technology*".

Bensberg, Dewanto and Grob (2004): This study describes a product life cycle (development, deployment, use, and evaluation) for new open source LMS developed by the University of Muenster (Germany). The developers used JAVA technology and J2EE to implement the system.
This kind of LMSs called Open University Support System (OpenUSS). The technical staff found out that the J2EE is an excellent way to develop such OpenUSS and manage system complexity.

Graf and List (2004): This study represents an evaluation of open source e-learning platform. It focuses on the adaptations capabilities of the system. The evaluation process used the Qualitative Weight and Sum (QWS) approach to evaluate LMSs. This study includes nine platforms to analyze them in detail . As a result of this evaluation, Moodle opened source LMS obtained the best result in the general as well as in the specific adaptation evaluation.

Granić, Glarinić and Stankov (2004): These authors gave the difference between delivering the learning materials synchronously and asynchronously and focused on the asynchronously delivery of materials. They also compared between the Intelligent Tutoring Systems (ITS's) and Tutor-Expert Systems (TEx Sys's) and showed that the ITS's are the starting point in e-learning development.
Any Intelligent Tutoring System has, in general, three users: (1) Experts, (2) Teachers, and (3) Students. Each user type has his user-interface to connect with the system. The expert user, as a knowledge designer, connects with the authoring shell directly. The teacher, as a courseware designed, connects with the

knowledge database by the ITS. The student, as a knowledge user, con nects with the courseware –which was designed by the teacher– by using the ITS user-interface.

In this paper, the authors provided a methodology to usability evaluation web-based educational systems. This methodology comprised three methods:

1. A scenario-based usability test,
2. A guide-list evaluation,
3. A usability questionnaire.

Hultin (2004): This study is about the LMSs and how to evaluate them depending on learning environment and users' needs from the LMSs. It offers a lot of questions for LMSs' vendors and users to describe the systems and assess them. It focuses on the usability of any information management system and classifies the usability to four parts: user-interface, table of contents "like site map", help sub-system, and the language environment used in the platform. This study shows the difference between the asynchronous and synchronous communication inside the learning environment for LMS.

Wyles (2004): This study contains two parts. The first part describes the findings of an initial evaluation of open source LMS's software. It aims to select a system that provides all major features and benefits which are available in commercial LMS's software.

The researcher used the Eduforge (www.eduforge.com) online survey tool with the evaluation of LMSs. The recommendation from this initial evaluation is deploying the following LMSs in a test-bed environment from further in-depth evaluation, which are: ATutor 1.3.3, Ilias 3.0.0 Beta, and Moodle 1.2 Beta.

This evaluation methodology contains these three main phases:

1. Identifying candidates,
2. Developing initial education criteria,
3. Selecting short-list for in-depth analysis.

The second part describes the evaluation methodology to select the core LMS as a part of the over all platform architecture.

Barre, Choquet and El-Kechai (2005): This paper is for experimenting the collaborative LMSs. It shows how communication's tracks are analyzed and how this analysis is useful for reengineering purposes. This paper shows that all tracks arising from communication tools allow to build indicators for all system's actors (learners, instructional designers, tutors, and analysts).

Bremer and Bryant (2005): Otago Polytechnic has been using Blackboard as a LMS in its campus. Academic staff and students are familiar in using it, and also the IT support (ITS) are experienced in administrating this system. The idea is to change the current LMS to new Moodle opened source system. The ITS activated Moodle system as a trial, in parallel with Blackboard for one computer course only. The risk was if the academic staff and students could not understand and use the new system easily! The result was that the students worked on Moodle easily and without any problems.
The Moodle opened source system requires a platform running Linux, Apache, My Structured Query Language (MySQL), and Hypertext Preprocessor (PHP). This set of applications is referred to as (LAMP).

Hiraki, Shibusawa and Yonekura (2005): This study is to describe a developed system named (Web-Com) for web-based education and the experiment to evaluate its asynchronous functions. The developers show that the web browser can be useful for channeling communications and for categorizing annotations.

Itmazi and Megías (2005): This survey is to compare and evaluate a group of Learning Content Management Systems (LCMS). As a result from this survey work, the WebCT is the most recommended package, while the Blackboard occupied the second, Moodle the third, and ATutor the fourth. Also, they found that Moodle is the most recommended Open Source Software (OSS) from the group of LCMSs in this study.

Knorr (2005): This study represents the evaluation of CMS in UBS University. This evaluation assesses the teaching and learning as well as historical, political, monetary and technical issues. This paper will take the WebCT used in the UBS as a subject for this evaluation. The evaluation will contain the pedagogical issues, usability issues, technical issues, upgrading the WebCT Campus Edition (CE) to WebCT Vista, and the expected costs.

Özçınar, Özdamlı and Uzunboylu (2006): This research aims to evaluate some opened source LMSs in the market. There are seventy two (72) systems available on the web, and the researchers selected eight of them to be included in their evaluation. They were: ATutor, Bazaar, Bodington, Claroline, Coursemanager, ILIAS, Moodle and Sakai.

All these software were evaluated by comparing each one to the other, depending on their features. The researchers used the edutools.org features' classification which includes: (1) communication tools, (2) productivity tools, and (3) student involvement tools.

They found out that the best file sharing is Bazaar. Some LMSs do not support e-mail service yet, so, users should have an e-mail from other hosts. All software's support the bookmarks, except Claroline and Bazaar. ATutor supports the helpdesk and online courses about the using of software. Other software's include online manual for help. All systems support the portfolio system.

Winter (2006): He studied three LMSs in his research –Moodle, WebCT, and Sakai– and their market penetration and found that the Moodle takes the first place with more than a half of combined market, while WebCT and Sakai have the remaining proportion.

Arh and Blažič (2007): This study deals with a complex decision making problem, the evaluation of LMSs and multi-attribute decision making. This paper discusses Multi-Attribute Decision Support Models and shows the decomposition of complex decision problems. The result of such decomposition is a hierarchical structure of decision making.

The authors defined the decision making as: "*Decision Making is a process of selecting a particular option from a set of possibilities, so as to best satisfy the aims or goals of the decision maker*".

Çavuş (2007): This Ph.D. dissertation studied the using of LMSs and their effects on the collaborative learning for the teaching programming languages and took Java programming language as an application case. This dissertation studied the students' opinions for the difference in usage between the Standard Collaborative Learning Tool (SCLT) and Advanced Collaborative Learning Tool (ACLT) in Near East University, and results that the ACLT has helped students a lot during the teaching of a programming language. A CLT offers every member of the group the ability to see each other's screen (Çavuş, 2007).
This study had offered a Virtual Learning Environment system by using Moodle LMS virtual environment and activated it in Near East University (NEU) for the Computer Information systems (CIS) department students and called it NEU - VLE.

Kavcic, Kavsek, Kaljun and Vicic (2007): This study aimed to help the people who are involved in e-learning field in order to find the best LMS that may suit them. The authors classified the users of LMSs to three groups: learners, tutors, and administrators. This paper also discussed and indicated the main methods used in comparing and evaluating LMSs. The results found out are as stated in table 2.1.

Table 2.1: Different comparison methods used in revised papers

Method	**No. of papers**
Feature comparison	17
Learning paths support	1
SCORM specs	1
OSS compliance	1
Student centered	1
Learning tools based	1
Technical specs	1
Features usability	2
Funct., techn., comm.. req.	2
Conversational Framework	1
Use-case and feedback	1
Questionnaire based	2

Malakhoff (2007): This report is to evaluate the Census LMS in the USA. As a result of this study, it was clear that this system requires little amount of programming to make the system more accessible.

There is a lot of evaluation projects and comparison operations d one over the LMSs and CMSs but the most of them are paper works for one, two or three LMSs up to 10 at maximum. In order to find a computerized tool for evaluating or comparing LMSs, noted that some solutions based on MS -Excel spreadsheet application. But in general, they were not professional solutions. They depend on a little number of criteria and done over one LMS only and needed a good experience in LMS stricture. There is one site offers a service to evaluate and compare LMSs and CMSs over the web, wh ich it is EduTools (http://www.edutools.com/). EduTools is owned and operated by the Western Cooperative for Educational Telecommunications (WCET). It is a computerized tool designed to make evaluation and comparin g operations for LMSs over the web. After testing this site, there is some features for it aren't flexible for user and depends on a little number of criteria for evaluating LMSs and some of them are confused to understand by the new user for LMSs. Chapter 7 will give detailed explanation to the most important features of this site and will also compare it with the system we are going to develop through this study.

2.3 Summary

In consequence of reading these twenty four researches and academic papers (done from 2002 to 2007) for the purpose of finding out what is the new in the field of decision making which applied on the LMSs evaluation, I have got the following findings:

1. Most of evaluation operations were done by making and analyzing surveys manually.
2. A few number of evaluation operations were done by using computerized technology and most of them were made by using Microsoft Excel applications.

3. Every evaluation operation gives us an independent classification of LMSs' features, but all of them concentra te on the technical, pedagogical, and administrative features.
4. If anyone wants to evaluate any LMS, he/she firstly should know what do these terms exactly mean: high availability, usability, scalability, interoperability, stability, and security.
5. It is possible to operate two or more LMSs in parallel inside one educational organization in order to evaluate which one is working better than others depending on students and teachers opinions.
6. Most of evaluation operations were done over the open source systems like Moodle, ATutor, and Ilias.
7. The most open source LMSs require a platform running Linux, Apache, MySQL, and PHP; this set of applications is referred to as a LAMP.
8. Moodle LMS is the mostly use in the educational organizations, especially in universities.
9. There is more than one method to make comparisons between two LMSs or more; the most used method is the feature comparison method.

Chapter 3

THE EVALUATION METHOD

3.1 Introduction

The main goal of this thesis is to develop a web-based DSS to evaluate LMSs over the web by using a flexible and smart algorithm which will contain some steps to be completed. This algorithm is clever; using some artificial intelligent concepts with fuzzy logic values.

This algorithm contains a mathematical equation depending on taking multi-attribute entities and a degree of importance for each attribute. This equation it the responsible to find the best LMSs from the group of systems included in the evaluation operation. The study here contains a complete description of the algorithm from the logical, mathematical, programmatic, applicable, and the user's view points.

3.2 Logical View

Logically, the evaluation operation will contain a number of steps in order to be completed. One should follow a sequence of steps to get the correct results at the end. Some of these steps need from us, as evaluators, to enter some values and entries. This data will be fuzzy values.

From this project, we aim to get one result that refers to a LMS. Such result is a major grade in the evaluation operation. In any evaluation operation, the user should give a group of entries depending on his/her own rating to the evaluation's elements. In the following, a list of all steps necessary for a complete evaluation operation:

1. We firstly should give the needed number of features to our LMS.
2. We should give the needed number of LMSs we want to include in the evaluation operation. *Note*: the LMSs included should match all features' group.
3. Now, we should weigh each feature included in the features' gro up and that your weight should depend on the degree of your needs. These values will enter the evaluation equation and affect on the result, as well.
4. Here, we should rank each feature to each LMS. This rank will give the degree of efficiency and performanc e of each feature inside each LMS.
5. In that case, we have to multiply each weight by the corresponding ranks of all LMSs.
6. Then, each multiplication result came out of the same LMS shall be added.
7. Each adding result came out of the previous step shall be div ided by the number of features entered in the first step. The group of results will be the group of grades of all LMSs included in the evaluation operation.
8. Now, we have to apply the maximum method in order to get the maximum grade came out of all results in the previous step. Consequently, the LMS which gets the maximum value will be the system we seek.

Actually, this algorithm works here over the LMSs evaluation, but it can work to evaluate any information system whatever its type. Generally, for LMSs evaluation, the evaluation operation may be done by users in different ways depending on this algorithm. Section 3.6, the user view, will discuss that clearly and also the case-study which follows, as well.

3.3 Mathematical View

3.3.1 Multi-attribute Decision Making Method

Every multi-attribute decision making problem have a group of criteria and alternatives, consider that we have m criteria and n alternatives. Let $C_1,.,C_m$ refers to the group of criteria and $A_1,..,A_n$ refers to the group alternatives. The decision making table below (Table 3.1) shows the standard of multi-attribute decision making methodology. In this table, each row represents a criterion and each column describes the degree of performance of each alternative. The score a_{ij} describes the performance of alternative A_j for criterion C_i. The higher score value means a better performance.

Table 3.1: The decision making table

		x_1	.	.	.	x_n
		A_1	.	.	.	A_n
w_1	C_1	a_{11}	.	.	.	a_{m1}
.	.	.	.	.	.	.
.	.	.	.	a_{ij}	.	.
.	.	.	.	.	.	.
w_m	C_m	a_{m1}	.	.	.	a_{mn}

As shown in the table, the weights $w_1,...,w_m$ are assigned to the criteria. For example, weight w_i represents the importance of criteria C_i in the decision, it is always positive. Usually, weights are representing the opinion of a single decision maker. On the other hand, the values $x_1,...,x_n$ assigned to the alternatives in the decision and they are the final ranking values of the alternatives. Usually, higher ranking value means a better performance of the alternative, so the alternative with the highest ranking value is the best of the alternatives.

We can partially or completely rank the multi-attribute decision making alternatives. Besides some monetary based and elementary methods, the two main families in the multi-attribute decision making methods are those based on the Multi-attribute Utility Theory (MAUT) and Outranking methods (Fülöp, 2005).

3.3.2 Linear Weighted Attribute Model

The five models proposed by Anderson (1990) for software selection were divided to two sets: compensatory and non-compensatory models. One of them was the "*Linear Weighted Attribute Model*".

In this model, each attribute used here should get a performance rating, or weight. These weights are assigned to the attributes which represent the compensatory nature of this model. The other variable is the rank. It is the frequency degree of a specific attribute of one element from the evaluation members. The final score will be defined by the following equation:

$$S_i = \sum_{j=1}^{n} (W_j * R_{ij})$$

Where: (S_i) is the score of the element (i),
(W_j) is the weight assigned to criterion (j),
and (R_{ij}) is the rank of (i) for criterion (j).

Thus the final score for a package is the sum of the weighted performance scores.

One of the most important models which were proposed by Anderson (1990) is *Elimination By Aspects (EBA)*. This model ranks the attributes by the importance in descending order, and sets a minimum value to each attribute. Packages that do not conform with the minimum of the first attribute are eliminated; the remainder is tested against the second attribute's minimum, and so on.

In our case, the *Linear Weighted Attribute Model* equation will give us the score of the (i^{th}) system included in the evaluation operation. It results the summation operation of multiplying the weights group by the corresponding ranks of the (i^{th}) system.

In fact, we need to get an independent grade, or general score, for each LMS in the evaluation operation overall its features group. Means that, the score shall be common for all attributes in the operation, therefore, we have to divide the result came out of applying the Linear Weighting Attribute Model by the total number

of attributers, or features included in the evaluation operation. The equation will be:

$$G_i = \frac{\sum_{j=1}^{n} (W_j * R_{ij})}{n}$$, where (n) is the number of attributes

As stated before, this equation will give us the general score of the (i^{th}) LMS in the evaluation operation for all attributes. This equation will be applied to each system included in the operation where the total number of systems is (m). The equation will be as follows:

$$G_i = \left. \frac{\sum_{j=1}^{n} (W_j * R_{ij})}{n} \right|_{i=1}^{m}$$, Where (m) is the number of LMS's

After applying the *Linear Weighted Attribute Model* equation to all systems in the evaluation operation, getting a score to each system, and dividing each score by the number of attributes, we thereupon will get a group of scores for all systems. When applying the maximum method to the scores to get the maximum one, then it will be clear that the system which takes the maximum score will be the one which we seek.

3.4 Applicable View (System View)

This section displays how we can apply the *Linear Attribute Model* equation to our evaluation system. Here, we will call the attributes as (the group features), and the evaluation elements or the alternatives as (the LMSs group) which are included in the evaluation operation. We can summarize this algorithm by looking at the table 3.2 and the equation that follows:

Assume we have these variables:

Group of features: $F_1, F_2, \ldots F_n$

Group of LMSs: $LMS_1, LMS_2, \ldots LMS_m$

Weights values: $W_1, \ldots W_n$

Ranks values: $R_{11}, \ldots R_{mn}$

Table 3.2: The representation of the relations between weights and ranks in the decision making table

Features Group	F_1	F_2	F_j	F_n
Weights	W_1	W_2	W_j	W_n
LMS_1 Ranks	R_{11}	R_{12}	R_{1j}	R_{1n}
LMS_2 Ranks	R_{21}	R_{22}	R_{2j}	R_{2n}
LMS_i Ranks	R_{i1}	R_{i2}	R_{ij}	R_{in}
LMS_m Ranks	R_{m1}	R_{m2}	R_{mj}	R_{mn}

The final equation for whole the evaluation operation will be as follows:

$$\mathrm{MAX}_{i=1}^{m}\left(\frac{\sum_{j=1}^{n}(W_j * R_{ij})}{n}\right)$$

The Maximum from i=1 to m for the

*((Summation from j=1 to n for (Weight $_j$ * Rank $_{ij}$) Over n)*

Where; *m* : the number of LMSs in the evaluation operation

n : the number of features in the evaluation operation

i , j : counters

Below, we can follow the mechanism of the evaluation operation depending on the system's view and its application:

1. The number of features (m) should be given in the integer data type.
2. The number of LMSs (n) also should be given in the integer data type.
3. Weighing each feature from the features' group ($F_1, F_2, \ldots F_n$) depending on the user needs ($W_1, W_2, \ldots W_n$). The weighing values will use the fuzzy values from 0 to 1. “One” symbolizes the most important feature to you. “Zero” symbolizes the unimportant feature.
4. Ranking each feature of each LMS (from R_{11} to R_{mn}). Your ranks will also use the fuzzy values from 0 to 1. “One” when you give the system a full mark on a specific feature. “Zero” when you see that this feature is not included in this system.
5. Multiplying each weight ($W_1, W_2, \ldots W_n$) by the corresponding ranks (from R_{11} to R_{mn}) of all systems means: $W_j * (R_{1j}, R_{2j}, \ldots R_{ij} \ldots R_{mj})$.
6. The group of results that came out of the above step for the same LMS shall be added together. This means: the results came out of multiplying all weights with ranks from same value of (i) shall be added to each other.
7. Each summation result above-stated shall be divided by the number of features. In our case, it is (n).
8. Applying the maximum method here is to get the maximum value from all results occurred in the previous step. The system which gets the maximum grade will be our LMS that we seek.

3.5 Programmatic View

Our system is a web-based DSS to evaluate some LMSs. Programmatically; we shall use some programming tools in order to design a general method to be easily programmed later on as a real system. The following pseudo-code will explain this algorithm and its method clearly. By using this pseudo-code, it will be possible to translate into any programming language we want. This thesis offers a web-based evaluation system, so in our case; we used the Visual Basic .Net is the applicable.

Assume:

```
m = number of LMSs
n = number of features
W = array of all weights
R = array of all ranks
temp = temporary array
```

```
START

Dim  m, n        As Integer
Dim  i, j        As Integer
Dim  sum         As Integer
Dim  W [n]       As Double
Dim  R [m, n]    As Double
Dim  temp [m, n] As Double
Dim  result [m]  As Double

Sum = 0

For i=1 To n
     Input W[i]
Next i

For i=1 To m

     For j=1 To n
          Input R[i,j]
          temp[i,j] = W[j] * R[i,j]
     Next j

Next i

For i=1 To m

     For j=1 TO n
          sum = sum + temp[i,j]
     Next j

     result[i] = sum / n
     sum = 0

Next i
```

```
Dim MAX As Double = 0

For i=1 To m

     If MAX < result[m] Then
          MAX = result[m]
          Print MAX
     End If

Next i


END
```

3.6 User View

We have benefited from this algorithm in designing our web-based evaluation system. We applied and programmed it by using Visual Basic.Net, ADO.Net, and ASP.Net. Our evaluation operation contains five (5) steps. Some of them are to insert the entries needed to the algorithm. We should know that the total number of features is (52), and we have to choose our group of features from them. So, the number of features (*n*) will be based on how many features we chose from the total (52). On other hand, the total number of LMSs included in our web-based system is (12). Our system will select only the LMSs that match the group of features had chosen. See chapters 4 and 5 to know more about the features and LMSs presented in our evaluation system.

In the following, you will find some explanations for the five steps of the evaluation operation. For more explanation, see the system's user guide (chapter 6.3).

1. Choosing the group of features you want to be included in your of LMS you seek. You will choose them from the 52 features offered.
2. The system will check all of the (12) LMSs stored in its database. This step will return a group of systems depending on your features selected. Your job here is to select which of LMSs you like to enter in the

evaluation operation. You can choose all of them but not less than one system.

3. This step is to weigh each feature inserted in the features group you chose in the first step. Your weights given here will depend on your needs. The weighing method will use the values from 0 to 1. “One” is for the most important feature to you. “Zero” is for the unimportant feature.
4. This step is to rank each feature with each of LMS depending on the features’ description given to you from the site. Here, your ranks will also use the values from 0 to 1. “One” when you give the system a full mark to its feature. “Zero” when you see that this feature is very bad to this system.
5. This is the getting results’ step. Here, all the mathematical evaluation operations are made. The site will give you a lot of results in this step. The grade of each of LMS inside the evaluation operation.
    a. The LMS which takes the best grade.
    b. Summary to all similar evaluation operations done before with the same group of features you chose in the first step.
    c. Full description for all LMSs included in the operation. Here, you can give your opinion and see all opinions had given before by the visitors or users about these systems. Also, you can discuss a feature for any of LMS in our operation.
    d. The administrator’s advice about the LMS he/she prefers to you, depending on the his/her viewpoint and your needs.

Taking all results shown here in consideration, you can decide which LMS su its you best and fits your type of using. As we see, these steps are very easy to the novice user. This means that the visitor to our site doesn't need any special skills to use it. In the figure below (Figure 3.1), you can see the six steps and the relationship among them:

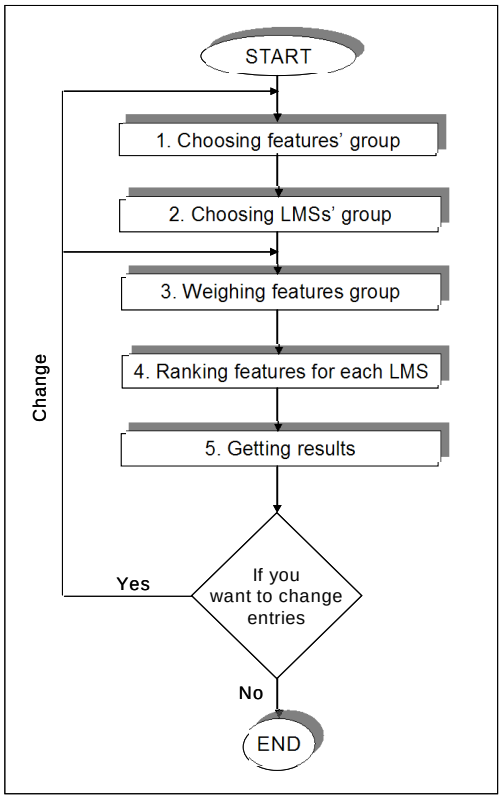

Figure 3.1: The evaluation operation flow-chart

3.7 Case Study: A Real Example on a Complete Evaluation Operation

In the following, you are going to see an example on a complete evaluation operation classified according to the five steps listed before in user view section. These steps in a mathematical method are shown here to see how the algorithm works:

STEP [1]: Choosing the features' group

Table 3.3 below is a draft design of the step number 1 of our system. It shows the list of all features (the 52 features). $F_1, \ldots F_{52}$ refers to the features names. The user can choose the group of features by clicking on the check boxes near each feature's name.

Table 3.3: A draft design of the list of whole 52 features

☐ F_1	☐ F_2	☐ F_3	☐ F_4	☐ F_5	☐ F_6
☐ F_7	☐ F_8	☐ F_9	☐ F_{10}	☐ F_{11}	☐ F_{12}
☐ F_{13}	☐ F_{14}	☐ F_{15}	☐ F_{16}	☐ F_{17}	☐ F_{18}
☐ F_{19}	☐ F_{20}	☐ F_{21}	☐ F_{22}	☐ F_{23}	☐ F_{24}
☐ F_{25}	☐ F_{26}	☐ F_{27}	☐ F_{28}	☐ F_{29}	☐ F_{30}
☐ F_{31}	☐ F_{32}	☐ F_{33}	☐ F_{34}	☐ F_{35}	☐ F_{36}
☐ F_{37}	☐ F_{38}	☐ F_{39}	☐ F_{40}	☐ F_{41}	☐ F_{42}
☐ F_{43}	☐ F_{44}	☐ F_{45}	☐ F_{46}	☐ F_{47}	☐ F_{48}
☐ F_{49}	☐ F_{50}	☐ F_{51}	☐ F_{52}		

Notes:

- *F_1 to F_{52}* represents the features' names.
- The squares before the features' names are Check_Boxes, and by using them, you can choose the feature to be inserted in your system that you seek.
- The user can choose all or some of them depending on his/her needs.
- In this example, we chose 4 features (F_1, F_2, F_3, and F_4).

STEP [2]: Choosing the LMS's group

In this step, the system will retrieve the LMSs that match the group of features chosen in step 1. You can choose all or some of them to be included in the evaluation operation.

Note:

Assume we have LMS_1, LMS_2, and LMS_3. These represent the LMSs' names.

STEP [3]: Weighing the features group

The user should weigh each feature existed in the group of features which we re chosen in step 1. Below, the features' names and their supposed weights are indicated.

F_1 weight = **0.5**

F_2 weight = **1**

F_3 weight = **0.2**

F_4 weight = **0.8**

STEP [4]: Ranking each feature to each LMS.

Table 3.4 below shows the values of each rank given by the u ser.

Table 3.4: Ranks given by the user

Weights	**W_1 = 0.5**	**W_2 = 1**	**W_3 = 0.2**	**W_4 = 0.8**
LMS_1	0.6	0.4	1	0.3
LMS_2	0.9	0.5	0.2	0.8
LMS_3	0.4	0.5	1	0.2

STEP [5]: Computing and getting results.

This step explains, simply and clearly, how to apply the evaluation operation's algorithm. Firstly, we store the weights given by the user to all features as one set. Secondly, we store the ranks of each LMS as another set, see table 3.5 below.

Table 3.5: The complete sets of weights and ranks

	W1 = 0.5	**W2 = 1**	**W3 = 0.2**	**W4 = 0.8**
	F_1	**F_2**	**F_3**	**F_4**
LMS_1 →	0.6	0.4	1	0.3
LMS_2 →	0.9	0.5	0.2	0.8
LMS_3 →	0.4	0.5	1	0.2

The algorithm will multiply the first set (the weights) by other sets, each one independently; see figure 3.2 below. This figure s hows the multiplication operation that was done to all features (F_1, F_2, F_3, and F_4) of all LMSs (LMS_1, LMS_2, and LMS_3). The numbers near each node stands for the sequence of operations.

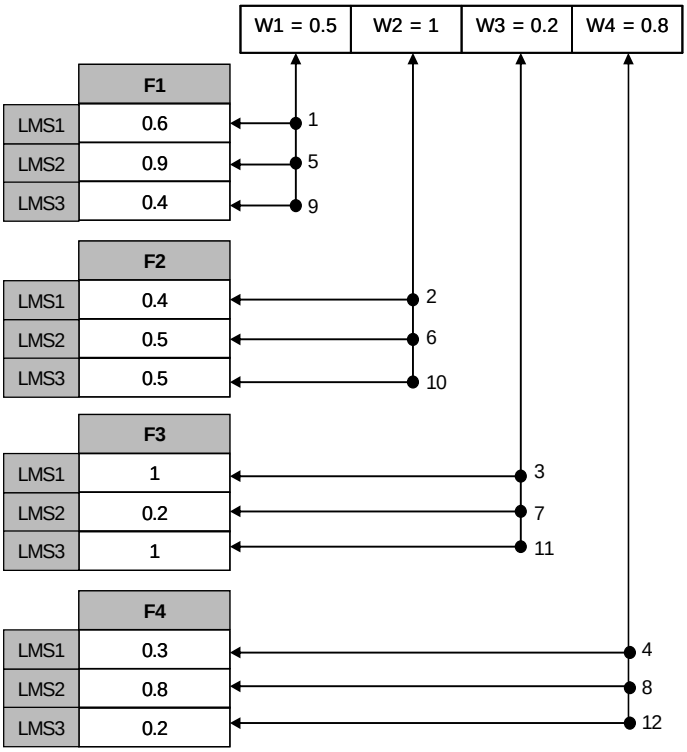

Figure 3.2: The multiplication operations for each weight with its corresponding ranks

The results taken out from the multiplication operation are mentioned in the following table (Table 3.6):

Table 3.6: The multiplication operation results

	Weight for F_1 = 0.5	**Weight for F_2 = 1**	**Weight for F_3 = 0.2**	**Weight for F_4 = 0.8**
LMS_1	0.5 x 0.6 = 0.30	1 x 0.4 = 0.40	0.2 x 1.0 = 0.20	0.8 x 0.3 = 0.24
LMS_2	0.5 x 0.9 = 0.45	1 x 0.5 = 0.50	0.2 x 0.2 = 0.04	0.8 x 0.8 = 0.64
LMS_3	0.5 x 0.4 = 0.20	1 x 0.5 = 0.50	0.2 x 1.0 = 0.20	0.8 x 0.2 = 0.16

After that, the algorithm will find the summation for each row.

Row 1 (LMS_1): 0.30 + 0.40 + 0.20 + 0.24 = 1.14

Row 2 (LMS_2): 0.45 + 0.50 + 0.04 + 0.64 = 1.63

Raw 3 (LMS_3): 0.20 + 0.50 + 0.20 + 0.16 = 1.06

The next step is to divide each summation result by the total number of features (*n*); in this example it equals 4.

LMS_1 → 1.14 / 4 = 0.285

LMS_2 → 1.63 / 4 = 0.408

LMS_3 → 1.06 / 4 = 0.265

Now,

the first LMS takes (29%) grade,

the second LMS takes (41%) grade,

and the third LMS takes (27%) grade.

As we see, the best one is **the second LMS** with grade 41%.

This is the first result. The second one is the administrator's advice which depends on the administrator's already given ranks by the evaluation system we have offered, but not on the ranks given by users. To compute this result, we have to change the user's ranks to the administrator's ranks and apply the algorithm again to find this second result.

3.8 Summary

This chapter represented the evaluation method used in the system applied in this study. It discussed the methodology from five main view-points; logical, mathematical, applicable, programmatic, and user view-points. It also represented and described the developed algorithm for the decision making technique to evaluate LMSs' operation in the system, how it works and how we apply it in this system. This chapter also offers a case study for an example on a complete evaluation operation.

Chapter 4

LEARNING MANAGEMENT SYSTEMS' FEATURES ANALYSIS

4.1 Introduction

This chapter is assigned to show the analysis operati on results of the LMSs' features. After searching and studying the main features which may be existed in any LMS, we have found out fifty two (52) features classified to six main factors. These features will be the criteria that will be used in evaluating the systems. You, as an evaluator have to weigh each feature in your evaluation operation depending on the degree of your need to it to be found in your LMSs you seek.

4.2 Analyzing the Features

The following classification is used in our LMSs' evaluatio n and also in designing the evaluation web-based system included in this thesis. Accordingly, the fifty two (52) features are classified to these six main factors, as follows:

A. Pedagogical Factor,
B. Learner Environment,
C. Instructor Tools,
D. Course and Curriculum Design,
E. Administrator Tools,
F. Technical Specification.

Hereinafter, we are going to display this classification, depending on the six main factors previously-mentioned, and that some of them may have sub-factors:

A. Pedagogical Factor (*learner and instructor view)*:

1. View course objectives
2. View course activities
3. Feedback for users
4. Self-assessing for students
5. Students' progress tracking and monitoring for teachers

B. Learner Environment:

- ***Communication:***
  - *Synchronous:*
    6. Real-time chat room
    7. Audio/Video conferencing
    8. Whiteboard
  - *Asynchronous:*
    9. Discussion forums
    10. File sharing
    11. Internal e-mail
    12. Online journal
- ***Search***
    13. Metadata and keyword search engine
    14. Search within courses
15. Calendar/progress review
16. Student profile
17. Work offline

C. Instructor Tools (*Course Development)*:

18. Online editor for course organization
19. Online quiz editor
20. Grade distribution

D. Course and Curriculum Design:

21. Automated testing
22. Online grading
23. Course templates

24. Curriculum management
25. Customize look and feel
26. Automated glossary
27. Index for courses

E. Administrator Tools:

28. Authentication
29. Course Authorization
30. Validation of input
31. Automated registration
32. Student transcript
33. Course creation, duplication, and deletion
34. Course and web site back-up
35. Statistics
36. First and last access date for courses

F. Technical Specification:

- Hardware/Software
    37. Client browser required
    38. Database required by the course management system
    39. UNIX server
    40. Windows server
- Technical Support
    41. Help desk
    42. Instructor's technical support
    43. Student's technical support
    44. Data recovery
    45. Multi-languages support
- Pricing/Licensing
    46. Company profile
    47. Cost
    48. Open source

- Limitations
    49. Number of courses
    50. Number of students
    51. Number of instructors
    52. Number of connections

This system will be dynamic and easy to use by all users, administrators and visitors. According to this, the administrator can re-edit any feature form the 52 features as needed; he/she can change the feature's name or its definition. In the following, you can see the full definitions of all features' list of our evaluation system. These definitions take into consideration the user and technical views and describe and explain them in an easy way to all uses' types. All this information will be inserted in the system's database by using a form from the administrator page in an easy way (see chapter 6.3.3.5).

4.3 Features' Definitions

1. **View course objectives:**

View course objectives service offers a frame to state course learning goals and objectives to students.

2. **View course activities:**

View course activities service offers a frame to describe lesson activities to students.

3. **Feedback for users:**

Feedback service to students lets the system offer immediate feedback to all LMSs' users.

4. **Self-assessing for students:**

Self-assessment tools allow students to take practice or review tests online and assessing themselves (i.e. practice sessions, survey style assessment, reminders,

etc.). Self-assessments encourage students to bear responsibility in their own learning and also monitor their learning progress. Self-assessments can also facilitate student motivation if students receive feedback on the self-assessments and if there is a direct connection between self-assessments and the measuring instruments which the instructor uses to determine final course grades.

5. Students' progress tracking and monitoring for teachers:

The system allows the instructor to display the progress of individual students (e.g., their participation). It also allows the instructor to monitor student's learning.

6. Real-time chat room:

Real-time chat is a conversation between people over the Internet that involves exchanging messages back and forth at virtually the same time. Chat includes facilities like Internet Relay Chat (IRC), instant messaging, and similar text exchanges in real time. Some chat facilities allow the chats to be archived for later reference. Some chats can be moderated, similar to the notion of "passing the microphone." Other chats can be monitored, where an instructor can view the conversation in a room without their presence being broadcast.

7. Audio/Video conferencing:

Enables two or more people in real-time voice and picture (video) to verbally communicate by microphone, speaker, and cameras or by conference call interaction as part of the session. Audio/Video services enable instructors to either stream video from within the system, or else enable video conferencing including voice, either between instructors and students or between students. Audio/Video Services include tools for broadcasting video to those without a video input device. Some video services provide for two-way or multi-way video conferencing which may be point-to-point connections or mediated through a central server.

8. Whiteboard:

Whiteboard tools with or without archiving options include an electronic version of a dry-erase board used by instructors and learners in a virtual classroom (also called a smart-board or electronic whiteboard) and other synchronous services

such as application sharing, group browsing, and voice chat. Application sharing allows a software program running on one computer to be viewed, and sometimes controlled from a remote computer.

For example, an instructor using this feature can demonstrate a chemistry experiment or a software utility to an online student and allow the student to use the demonstration software from their own compute r. Group Web Browsing allows an instructor to guide learners on a tour of web sites using a shared browser window. Voice chat allows two or more to communicate in real time via microphones, conference call style, over an Internet connection.

9. Discussion forums:

Online tools that capture the exchange of messages over time, sometimes over a period of days, weeks, or even months. Threaded discussion forums are organized as categories so that the exchange of messages and responses are grouped together and are easy to find. Discussion forums can be created for individuals or small groups. For example, in a tutoring environment, this could be a one -to-one communication between tutor and student.

Discussion forums tools are very similar to newsgroups where text co nversations over time are displayed. The organization of the messages can be a simple temporal sequence or they can be presented as a threaded discussion where only messages on a specific topic called a thread are displayed in sequence.

10. File sharing:

Allows students to upload files from their local computers and share these files with staff, teachers, or other students in an online course. This could be real -time or asynchronous exchange. Note: File attachments to messages are part of Internal Email and Discussion Forums. These tools enable downloading files and upload or posting files over the Web from within the course.

11. Internal e-mail:

Internal email is electronic mail tools that enable messages are read and sent exclusively inside the course or alterna tively the tools enable links to external

email addresses of those in the course so that contacting course members is facilitated. It may include an address book and some address books are searchable.

12. Online journal:

Online Notes/Journal tool enables students to take notes or keep a journal about course experiences in a personal or a private workspace, either for the student's private use or to be shared with other student, instructors, or the system's staff. This tool can be used to facilitate writing assignments where parts are written over time and then later assembled into a document. This tool also can be used to make personal annotations to pages of a course that can later be used as a study aide. The Online journal tool can also be used to record reflections about personal learning accomplishments and how to apply this new knowledge.

13. Metadata and keyword search engine:

This searching service depends on the keywords entered by the user which they are related to courses or knowledge. This tool searches deeply inside courses to find any materials related to the keyword entered by student and provide some links to connect him/her to the knowledge.

14. Search within courses:

Searching within courses is a tool that allows users to search among courses and find course materials based on course name, science field, or a word related to course.

15. Calendar/progress review:

Calendar/progress review tools enable students to document and update their plans to a course and the associated assignments in a course. Calendar/progress review tools often enable students to check their marks on assignments and test, as well as their progress through the course material. Students can sometimes compare their marks on an assignment with the average score on that assignment, view total points earned, total points possible and percentages per unit, per item and overall course grade.

16. Student profile:

Student Portfolios are areas where students can showcase their work in a course, display their personal photo, and list demographic in formation. Student Portfolios are often located on or are a part of students' personal homepages in each course. Some products provide a private folder and a public course or team folder that students can use to display their work. Students' personal homep ages typically give them access to course content, internal email, course announcements, and the course calendar.

17. Work offline:

Work offline is a set of tools that enable students to work offline in their online course and for their work to be synchronize d into the course the next time they log-in. Sometimes students can download course content to their local computers and work offline and sometimes they access content on a CD -ROM. Course content that resides on a CD-ROM can also be linked to dynamically w ithin the online course. A course placeholder automatically returns students to the location in their course where they were working the last time they logged off. The ability to work in a course environment offline and/or to automatically return to the location in the course where you were working the last time you logged off, is especially useful in situations where communication links are unreliable or expensive.

The offline environment is essentially a local client application that embodies the important features of the online product without a continuous connection to the Internet. Tracking and student performance data are automatically uploaded into and synchronized with the student performance database the next time the student logs in. The course pl aceholder tool is essentially an automated bookmark that returns users directly to the page of the course where they had stopped working the last time they logged off.

18. Online editor for course organization:

Online editor for course organization is an onli ne tool to enable the instructor to easily edit the structure of the course and content. The system automatically generates content navigation aids.

19. Online quiz editor:

Online quiz editor is an online tool that helps the instructor to easily edit questions and structure of test contents. The system offers features that assist in the making up of practice quizzes, tests, exams, and other assignments, assignment reminders.

20. Grade distribution:

Grade distribution means that the system allow instructors to gene rate grade distribution report (i.e. how many students got 90 and above, etc.).

21. Automated testing:

Automated testing includes the control of when and where tests may be taken and under what conditions, also includes system services for importing and expor ting tests and test banks as well as statistical analysis of test results.

22. Online grading:

Online Grading Tools enable instructors to mark assignments online, store grades, and delegate the marking process to teaching assistants. Some tools allow instructors to provide feedback to students, to export the grade -book to an external spreadsheet program, and to override the automatic scoring.

23. Course templates:

Course templates are tools that help instructors create the initial structure to an online course. Instructors use templates to go through a step -by-step process to set-up the essential features of a course. Course Templates are artifacts of particular pedagogical approaches to instructional content and process. The local value of particular templates wi ll depend in part on the match between the template designer's approach and the specific instructor's approach.

24. Curriculum management:

Curriculum management provides students with customized programs or activities based on prerequisites, prior work, or re sults of testing. Curriculum Management includes tools to manage multiple programs, to do skills/competencies management, and to do certification management. These tools may be similar to

the tools used in student services as part of providing academic adv ising to students.

25. Customize look and feel:

Customized Look and Feel is the ability to change the graphics and how a course looks. This also includes the ability to institutionally brand courses. It also includes the branding of content with institutional logos and navigation to provide a consistent look-and-feel across the entire institutional site and the integration of the system with additional institutional resources such as the library.

26. Automated glossary:

A tool allows the instructor to generate gl ossary and index for his/her course. It will be a useful way to search within the courses or with a keyword by users or by using the search engine if offered inside the system.

27. Index for courses:

It is a tool that allows the student to see a fully classif ication to all courses and links, pages, or materials related to them in the LMS depending on some indexes such as course title, science field, or the teacher who instructs the course.

28. Authentication:

Authentication is a procedure that works like a lock a nd key by providing access to software by a user who enters the appropriate user -name (login) and password. Authentication also refers to the procedure by which user names and passwords are created and maintained. It is a standard security practices focus on the handling of authentication credentials, and subsequent tokens to prevent reply attacks. Authentication systems can involve a single logon which is the most users friendly and most vulnerable to hacking. More complicated systems can involve layers with separate logins for each layer and secure socket layer transaction (SSL) encryption.

29. Course authorization:

After the user has been correctly authenticated, authorization mechanisms decide what the user is allowed to do. The course authorization tools a re used to assign

specific access privileges to course content and tools based on specific user roles, e.g. students, instructors, teaching assistants. For example, students can view pages and instructors can author pages. Students and instructors typicall y need different tools to complete their instructional responsibilities. For example, students need to be able to view their records in a grade book but instructors need to be able to view and modify the records of all students in the course. Most CMSs provide a small set of default user roles. Some systems allow institutions to add and define additional user roles.

30. Validation of input:

The LMSs can be used anonymously and form a huge number of users without any constraints on the level of their knowledge in computer's using skills, so, it must be hardened to validate all inputs from users specially in the required fields and the fields that have a special type of data. This tool checks the entries before sending it to store in the database or use it in oth er place of the system.

31. Automated registration:

This is a collection of web tools which allows the new users to insert their required information, check the entries, and give them a unique username and password to check their accounts in future. These too ls send notifications to the administrator and wait his acceptance on them. All notification will be pending till the administrator accepts them. After that, the LMS may send an email to the user telling him that the account is valid now.

32. Student transcript:

Student transcript tool form of the LMS allows students to obtain a transcript over his work on the course. It is an electronic transcript which shows the achievements to the student in a course or group of courses which the student had enrolled in.

33. Course creation, duplication, and deletion:

Course creation, duplication, and deletion tools allow the instructor to create a new course, edit one of his own courses, duplicate an already existing course, and delete one of his own courses. These tools also allow the administrator to create a new course, edit or duplicate any existing course, and delete any undesirable one.

34. Course and web site back-up:

Web site back-up and course back-up are important tools in any LMS. They may help us in any technical emergency case happen to the site or to the server. The administrator is the responsible to do these tasks. Some LMSs allow the instructors to make back-up for their own courses. Back-up to the site means to create a copy to the site with all its database and all active actions in that time. Back-up to a course means to create a copy to a course with all data related to it.

35. Statistics:

Statistics tools are very important to any administrator team in the LMS. Any perfect LMS should have some statistical features about it; like the number of users, access dates to each user, active and inactive users, courses related to each instructor, students' achievements, and any related information that the administrator may benefit from it.

36. First and last access date for courses:

This tool in LMSs is to track the first and last dates for accessing each course. In some LMSs, this tool is available for the instructor to view the access dates for each student enrolled in the course.

37. Client browser required:

Client browser required is the type and version number of the Web browser (e.g. Internet Explorer 5.0, Netscape 4.0) that works effectively with the LMS. Browser version numbers are important. If a product provider indicates that their CMS works with, for example, Netscape 4.78, that implies that it doesn't work with Netscape 4.5 or 4.0. On the other hand, if the product provider indicates that their CMS works, for example, with Netscape 4+ that implies that it works with all versions from version 4.0 up through and including the most current release of Netscape.

38. Database required:

Database Requirements are technical specifications for the database management software (e.g. Oracle or SQL Server) required by the CMS. Database Requirements involve the matching of APIs (Application programming interface)

between the specific version of the CMS and the specific version of the database software. This matching of the APIs must be kept current as upgrades to both types of software products occur over time. An important aspect of any software product is the hardware on which it resides. For some CMSs, the database requirements include hardware requirements.

39. UNIX server:

Unix Server means that the LMS runs on a server using some variant of the Unix operating system. The Unix Server feature includes general information about hardware requirements such as disk space, Random Access Memory (RAM), and Control Processing Unit (CPU) speed and model. The hardware requirements vary greatly based on usage and growth plans. We highly recommend that you check with the product provider for specific hardware requirements that fit your estimated usage and growth plans.

40. Windows server:

Windows Server means that the CMS runs on a server that uses some version of the Microsoft Windows operating system. The Windows Server feature includes general information about hardware requirements such as disk space, RAM, and CPU speed and model. The hardware requirements vary greatly based on usage and growth plans. We highly recommended that you check with the product provider for specific hardware requirements to fit your estimated usage and growth plans.

41. Help desk:

Orientation/Help tools are designed to help students learn how to use the LMS. Typically, these tools are self-paced tutorials, user manuals, and email or telephone helpdesk support. These tools enable students to make the best use of the software. They provide instruction about and job aids for using various aspects of the LMS. Student support tools may include context sensitive help, hints, and wizard style assistants. Some product providers include courses in how to study effectively and/or how to work in online groups. A student helpdesk does not typically offer help with course content.

42. Instructor's technical support:

This tool allows the instructor to benefit from the technical support service offered by company. This tool is found in different ways: by synchronous phone connections between the instructor and one of the administrating team members, by sending emails, or by retrieving or receiving so me documents, depending on his request.

43. Student's technical support:

This tool allows the student to benefit from the technical support service offered by company. This tool is found in different ways: by synchronous phone connections between the student and one of the administrating team members, by sending emails, or by retrieving or receiving some documents , depending on his request.

44. Data recovery:

Data recovery tool is a system's tool to catch a copy from the system and store it to be used in some em ergency cases like the system failure or run time errors or faults. The administrator is the responsible to do this task. This data recovery should contain site pages, users' information, and system's database.

45. Multi-languages support:

Some LMSs offer a support to some languages. This support may be customized depending on the customer need or the system will support some languages by itself.

46. Company profile:

The company profile includes public information about the company or organization that provides the learning management software. The company profile can include the following: Founding date, owners, investors, and/or founders, location of the organization, number of employees, stock exchange ID, previous company names, affiliations with other organiz ations or universities, and e-learning product acquisitions.

47. Cost:

Stipulate initial license fees or costs to the institution for all required products by product component. Expenses for maintaining the software/service after initial setup such as upgrades, licenses, contracts, and product support. Initial expense involved in purchasing or using the software or service. Is the product Commercial Off-the-Shelf (COTS)? Or Government Off-the-Shelf (GOTS)? Is the initial start up cost reasonable or high? Are the ongoing costs for maintenance and upgrade considered reasonable or high? Has the company indicated an interest in cost-sharing, donation, non-profit gifting? Start-up (installation) costs are the initial expenses involved in purchasing or using the sof tware. Ongoing costs are the expenses for maintaining the software after the initial setup, such as upgrades and new versions of the software. Technical Support Costs are the expenses of purchasing software assistance from the vendor, e.g., help desk for u sers via email and/or phone, assistance with servers, networks, or interfacing with other software.

48. Open source:

Open Source means that the software is delivered with the source code and the license agreement gives the licensee the right to modify and red istribute the software. A representative open source license is the GNU General Public License (http://www.gnu.org/copyleft/gpl.html). The official definition of Open Source software is maintained by the Open Source Initiative (http://www.opensource.org/in dex.php).

49. Number of courses:

Number of courses' service means that how many courses will be offered or delivered by the LMS. Some systems put some constraints on the number of courses developed by one instructor.

50. Number of students:

Number of students' service means that how many students can register or can be served to the LMS. Some systems put constraints on the number of students to each course.

51. Number of instructors:

Number of instructors' service means that how many instructors can be supported in the LMS. Some systems put constraints on the number of instructors who are responsible in developing the courses and instructing them.

52. Number of connections:

Number of connections' service means that how many connections can be supported to each user, teacher or student, in the LMS. Some systems put constraints on the number of connections especially to students. These connections may be counted by the number of login operations or by the number of hours or minutes to each login operation.

4.4 Summary

This chapter discussed the criteria that used in evaluating LMSs. Fifty-two features were founded after a huge research operation done over a lot of LMSs available over the web. These features will be our standard in the evaluation operation. Here, you can find a complete definition for each feature. We took in consideration, the technical and user view-points in defining each one of them.

Chapter 5

THE EVALUATED LEARNING MANAGEMENT SYSTEMS

5.1 Introduction

After making a series of search operations over the web in order to choose the list of LMS and CMS to be included in the evaluation system, I preferred to select 5 systems out of the 12 products mentioned in table 5.1 below because they are the most famous and widely-known used over the world specially in the universities and other educational organizations. The table below displays the products' names, versions, and if it is open source or commercial product.

Table 5.1: The list of LMSs included in our evaluation.

Product Name	Version	Cost
Moodle	1.7	Open Source
Moodle	1.8	Open Source
Moodle	1.9	Open Source
WebCT	3.8	Commercial
WebCT	4.0	Commercial
Blackboard	Vista 4.1	Commercial
Blackboard	5.0	Commercial
Blackboard	6.0	Commercial
Blackboard	7.0	Commercial
ATutor	1.5.3	Open Source
ATutor	1.5.4	Open Source
Claroline	1.8.1	Open Source

The 5 systems in the evaluation are: Moodle, ATutor, Claroline, WebCT, and Blackboard .A full description of each feature of all LMSs is included in Appendix B. of this study. Taking into consid eration, the technical and user view - points in describing each feature of each LMS. Hereinafter, there are some general and historical information about each one of them.

5.2 Moodle

Moodle is an open source community launched in 2001 that has grown out of a PhD research project by Martin Dougiamas. Version 1.0 was released on August 20, 2002. Moodle.com is a company launched in 2003 that sponsors Moodle development and provides commercial support, hosting, custom development, and consulting. The Moodle Partne rs are a network of companies that work with Moodle.com to provide services around the world. In September 2007, there were 69 Moodle installations with 20,000 or more users. The Moodle trust hires core programmers and covers project expenses. Moodle is pe rceived as high value in the education community, particularly higher education and further education.

Moodle is one of the most user - friendly and flexible open source courseware products available. It has excellent documentation, strong support for secur ity and administration, and is evolving towards Instructional Management Systems/ Shareable Content Object Reference Model (IMS/SCORM) standards with platform (Apache, PHP, and MySQL). The key to Moodle is that it is developed with both pedagogy and techno logy in mind. Great with languages although some development may be needed for robust handling of MathML and enhanced tracking features. Still, this program receives a high recommendation. Moodle is a student-centered CMS designed to help educators who wan t to create quality online courses. The software is used all over the world by universities, schools, companies and independent teachers (Catalyst IT Limited, 2003).

The software helps educators to create online courses and administer them to their students. With Moodle, teachers can format the courses they created in different

ways, and integrate lessons with collaborative activities such as workshops and glossaries.

5.3 ATutor

ATutor was originally developed as an open source Virtual Learning Environme nt (VLE) from Toronto University in Canada. It is a promising system that provides good documentation, ease of installation, and strong potential for development. While the user interface may not seem intuitive to many, the overall functionality is good (and wide open/modular) and the development team is committed to standards. The system is also install-friendly and receptive to new language versions. ATutor is one of very few systems that support learning object repositories. It is very strong on standard s and can import external content in IMS/SCORM format. ATutor scores highly for openness. It is written in a modular format and has many features and rates highly for usability, including accessibility for learners with disabilities. ATutor uses the platfo rm: Apache, PHP, and MySQL (Catalyst IT Limited, 2003).

In August 2003, a study was prepared by Iain Clements titled "Virtual Learning Environment Comparison – Moodle, Claroline, and ATutor". ATutor was the easiest of the three software systems to install. Once the files had been downloaded, decompressed and placed in the appropriate file on the web server, it was simply a case of navigating to the admin screen and running through the installation screens via an Internet browser.

In June 25, 2003, another study was prepared by Commonwealth of Learning (COL) on the LMS Open Source. This product has built-in content authoring, course and assessment support, and has strong collaboration features. In addition it has been designed for accessibility and multi-lingual use. It has good online help and a self-explanatory tutorial to assist new users. Furthermore it is a current design that takes full advantage of the best open source technology (Apache, PHP, and MySQL) and incorporates an awareness of the evolving e-Learning specifications. Instructors may import and export courses at their discretion. As it

is new, there is no large user base, although the developers seem responsive to support requests on their support forum.

5.4 Claroline

Claroline was created by a consortium of French University faculties who were included in developing an open source alternative to some commercial learning content management systems. Claroline has a broad user base, but there are questions over particular features, such as the grade-book, that are likely to be desirable by consortium partners, similar to Moodle and ATutor alternatives (Wyles, 2004). The development pathway indicates an increasing commitment to open standards.

5.5 WebCT

WebCT began as a project by a University of British Columbia (UBC) professor Murray Goldberg as part of a grant project to study the effects of online teaching on learning. Murray founded WebCT in 1997 at UBC, and delivered it as a commercial product at that time. In 1999 the company was acquired by Universal Learning Technology (ULT) and combined company was renamed WebCT.

Edwin M. Knorr at University of British Columbia made a study on CMS Evaluation and Strategy at UBC: A Viewpoint from the Faculty of Science and said, "As of early 2005, UBC's ITServices group hosts (on a single server) over 900 WebCT-enabled courses taken by up to 30,000 students per year — approximately 20,000 of whom use the system each week".

5.6 Blackboard

Blackboard Inc., based in Washington, D.C. (USA) is the creator of a wide variety of software products and services for education programs. Blackboard Learning System is a CMS allowing instructors to create or upload teaching and assessing

material (e.g. lessons, discussions and assignments) and determine when students can access it.

As a consequence to Blackboard's widespread use, pre -packaged course materials are provided by all major education publishers. Furthermore the system supports external content respecting the SCORM standard. Students can follow the lessons on-line, interact with the teachers, and with each other in different ways and access repositories of documents. In the University of Gävle, the system is used by the students of more than 120 classes, attending both distance and on location courses.

Blackboard has many clients in the US public service, and has close ties with the Department of Defense through work with the National Defense University and the ADL Co-Lab which implements the Defense Department's Advanced Distributed Learning initiative. The aim is to harness the power of information technology to modernize structured learning.

5.7 Summary

This chapter discussed the group of LMSs included in the evaluation. The system that offered in this study will be able to evaluate all these LMSs depending on t he features mentioned in chapter 4. This study has twelve versions including the five famous LMSs. A full description of each feature of each LMS is existed in appendix B.

Chapter 6

SYSTEM'S DOCUMENTATION

6.1 Introduction

This documentation will contain two main parts, the first one is the system's documentation from the technical view (see section 6.2), and the other is the system's documentation from the user view (section 6.3). System documentation is assigned to explain and document the web-based system which offered by this thesis. It is the suitable way to understand the system through its developing and applying phases. By applying this method, we will be able to analyze, design, and implement the system and know how each user will interact with it.

The documentation for users is the way to make the system understandable by the user, or the end-user, whatever their type of using. It is the suitable way to explain the system through the user view. In any software documentation operation, some of documenting processes should be done before starting in the programming phase and some of them after completing the system. The completion of the system here means finishing all developing processes of the system after evaluating and testing phases.

In order to document the system, we have to decide the method which will be used and followed in developing this system. The Unified Modeling Language (UML) technique was used as a part from the Computer Aided Software Engineering (CASE) tools in order to analyze the users' requirements and their processes. The Systems Development Life Cycle (SDLC) technique had been used in order to be followed in the system documentation operation. This technique comprises the following seven phases:

1. Feasibility Study
2. Analysis
3. Design
4. Implementation

5. Testing
6. Evaluation
7. Maintenance

6.2 Technical Documentation

6.2.1 Life Cycle

Before starting the software process cycle, we must determine the model we have to follow in the development process. As known, there are three main types of software process models:

1. The waterfall model,
2. Evolutionary development model,
3. Reuse-based development model.

In this case we will use the waterfall model for the following reasons:

- The objective of evolutionary development model is to work with customers and to evolve a final system from an initial outline specification. It should start with well-understood requirements, and work with the customer to explore their requirements and deliver a final system. The applicability of this model is possible for the following uses:
    1. For small or medium size interactive systems,
    2. For parts of large systems (e.g. the user interface),
    3. For short-lifetime systems.

- The reuse-based development model based on systematic reuse where systems are integrated from existing components or Commercial Off-the-Shelf (COTS) systems.

6.2.2 Feasibility study

Actually, the feasibility study to any software is one of the analysis phases. Any feasibility study should contain three main categories: economic, technical, and operational. Accordingly, each category will be applied in this system as follows:

6.2.2.1 Economic feasibility:

Benefits:

Tangible benefits:

Making the choosing operation of LMSs easier and more significant.

Intangible benefits:

The chosen LMS will satisfy users' needs excellently.

Costs:

On-time cost:

Hardware: good computer performance for programming and administrating the site.

Software: Microsoft Visual Studio .Net 2005 and Microsoft SQL Server 2005.

Tangible cost (for users):

Computer with network card and internet connection.

Intangible cost (for users):

The user should have a fair knowledge in operating and using the computers and the internet.

6.2.2.2 Technical feasibility:

In this case, it is supposed that the system is completely working without any bugs (logical or run-time bugs) or any technical problems.

6.2.2.3 Operational feasibility:

We designed this system to any one who wants to benefit from our service with free of charge fee. In addition, it is easy to use even with just fair kn owledge of using the internet.

6.2.3 Definitions and Specifications (Analysis Phase)

It is the hardest part in analyzing any information system. Collecting the requirements comprise two main points depending on their level of description: user requirements and system requirements.

6.2.3.1 User Requirements definition:

1. The system must provide a means for decision making.
2. It must include the most famous and important LMSs.
3. The system must be flexible and easy to use either to novice or to professional users.
4. The user may not have a clear background about the LMSs and their features, so we should take into consideration that the way of designing the system and the way of presenting data, must be clear and logical.

6.2.3.2 System Requirements specification:

1. The authorized individuals (our administrating team members) should be provided with facilities to access information about the structure of the project.
2. Unauthorized individuals are unable to gain access to the structure of the website or its database.
3. Making constraints on users: every user has his own limited authorizations.

6.2.3.3 Determining Requirements:

We have two methods for determining requirements:

1. Traditional method
2. Modern method

In this project, the *modern method has been chosen* to determine the requirements by using Joint Application Design (JAD) which is the suitable technique to determine such requirements. We approved our choice:

- Because we want to collect system requirements simultaneously from key users (educational organizations, instructors, and students).
- At the end of using this method we should have detailed features of the proposed system.

Functional Requirements:

1. The user of the system *shall* be able to gain access to the desired information.

2. The system *shall* inform the users what LMSs are.
3. The system *shall* provide some security issues, such as making it difficult to make vandalism in the website.
4. The system *shall* provide the expected users with appropriate tools to deal with and give them all information related to any LMS include d in the site.
5. The system *shall* offer a space to discuss and give any opinion by users to any LMS.
6. The system *shall* let the user make any comparison among the LMSs.
7. The system *shall* be flexible in comparing any LMSs with others depending on their similarit y of features.
8. The system *shall* take any entry from the user with high level of importance, because it may be important in building the decision.
9. The user *shall* give the system a level of importance of any feature needed in seeking for the LMS by weighing each feature separately.
10. After completing the evaluation operation, the system *shall* give the user the suitable choice needed.
11. The system *shall* give the user some advices to make the idea more clear.
12. The system *shall* expose all pervious experiences of th e users. It will provide them with a good background about the LMSs and it will help them in building their decisions.

Non-Functional Requirements:

1. Product Requirements (performance requirements):
   a) Our system should have high performance as it is a sma ll desk-space size project. There are not too much related images, audios, videos, and other multimedia files.
   b) The evaluation algorithm is very smart and fast to execute.

2. External Requirements:

   We guarantee that the system will be acceptable to all it s users and to the public in general, and will operate according to the law and ethical requirements.

3. The system must be usable by users for what it was designed . It should have an appropriate user interface and adequate documentation.
4. Dealing with the system should make the users comfortable and pleased.
5. The system should not take a lot of time of training to users.

System Domain Requirements:

The system is designed according to a standard user interface which shall be based on a specific standard. It sh ould be a constraint on the system. So, our system will use the "Master Page" control offered by the MS -Visual Studio .Net 2005 and 2008. This control gives a unified design to all pages in the system. Here, we will use the English language to be the inter action language in all pages of the system. Also, our system includes a main menu placed in the left side of all pages. It will contain the some links to connect us with the main parts of the system, like: the LMSs' evaluation part, the products comparing part, and products information part.

6.2.4 The Design Phase

Once the requirements specifications have been completed, the next major phase in the software development life cycle is the design phase.

The design phase consists of three major activities:

- The preliminary design of the user interface
- The preliminary design of the software structure
- Detailed design.

6.2.4.1 Preliminary design of the user interface:

The interface design of our system is very crucial to give success to the system. Before designing the system, it was very important to know the kind of users and

their experience. So, we divided the users into three categories according to their experience in using LMSs as follows:

i. Novice (e.g. normal visitor)
ii. Intermittent (e.g. teacher, student)
iii. Professional (e.g. a LMS administrator)

6.2.4.2 Preliminary design of the software structure:

Once the important decisions concerning how the system will look to the user have been made, the next step is to design an internal structure of the system. In designing software structure, the modules that are to comprise the system are designated, and inter-relations among all modules in the system are specified. If the software structure is not well-designed, then the system will be difficult to build, test or maintain.

For the preliminary design, it has been decided to use the UML. The R ational Rose Enterprise Edition is used as a CASE tool that may enable us to draw UML diagrams and to specify other data. Before starting the modeling process, the objects of the system have been identified and used the approach which depends on the personal experience because our system is an application system and it doesn't contain many sub-systems.

6.2.4.3 Process Modeling:

The most popular technique used in process modeling is Data Flow Diagram (DFD). It is a graphical illustration of data flow between processes and data stores.

Potential objects for the system:

1. Administrating the site
2. Products information
3. Evaluating sub-system
4. Comparison between products
5. Opinions and discussion

Our system will have two main types of its expected users:

1. System's administrator
2. Visitors

The following eight figures are the main DFD diagrams to the system:

1. *Context DFD diagram*: Shows the relationship between the system itself and its main users, what is the data that will be exchanged between the systems and user (see figure 6.1).
2. *Level-0 DFD diagram*: Shows the main sub-systems, or processes. It shows also the relationships between the users and each sub-system (see figure 6.2).
3. *Level-1 DFD diagram for process 1*: Shows all tasks for administrating sub-system and the relationship between them (see figure 6.3).
4. *Level-1 DFD diagram for process 2*: Shows how we can manage LMS's sub-system and its main tasks and their relation with the data sources for the system (see figure 6.4).
5. *Level-1 DFD diagram for process 3*: Managing LMSs features' sub-system and how we can access the data sources for the system (see figure 6.5).
6. *Level-1 DFD diagram for process 4*: Shows how we can manage the opinions and discussions sub-system (see figure 6.6).
7. *Level-1 DFD diagram for process 5*: Shows the LMSs' evaluation sub-system and its tasks. Also, it shows the relationship between this sub-system and the data sources of the system, as well (see figure 6.7).
8. *Level-1 DFD diagram for process 6*: Shows the comparing products sub-system and its relationship between the products and features sub-systems (see figure 6.8).

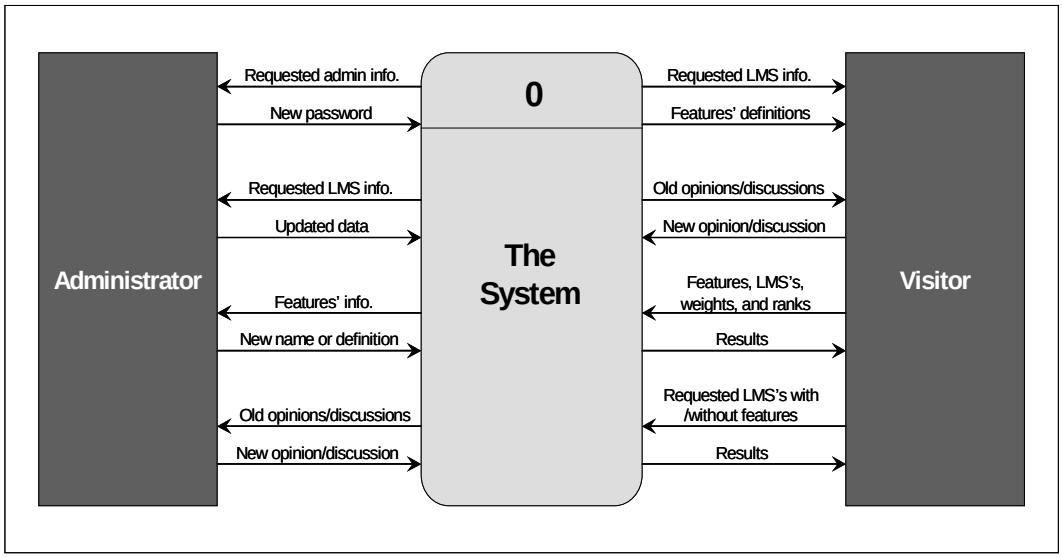

Figure 6.1: The Context DFD diagram for our system

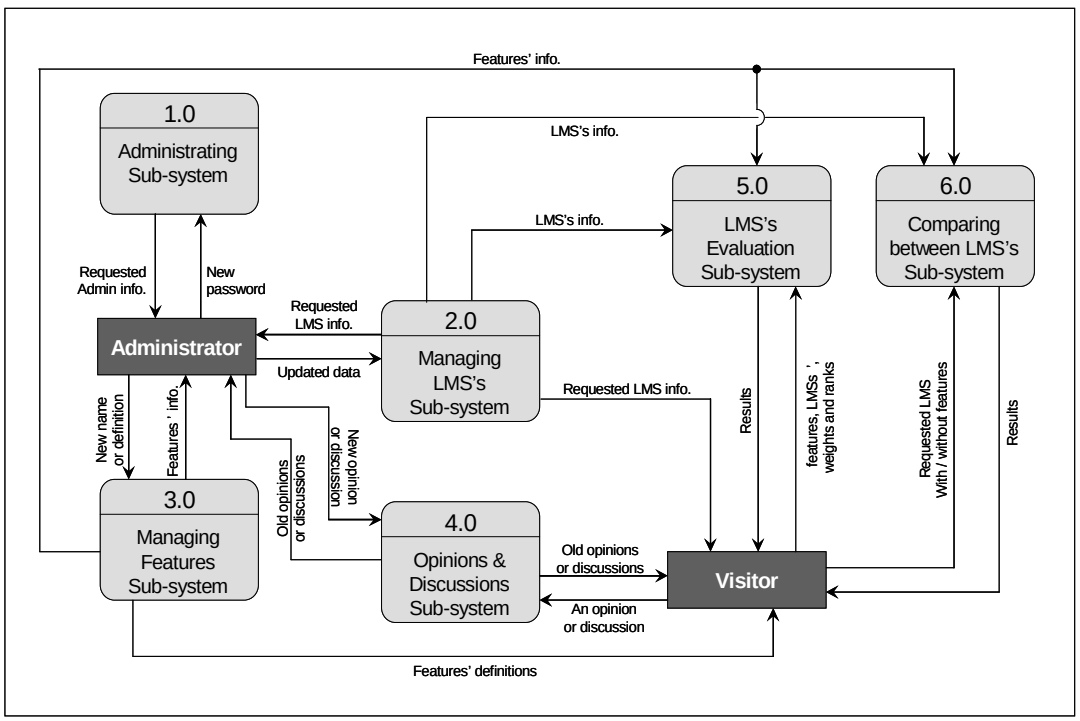

Figure 6.2: Level-0 DFD

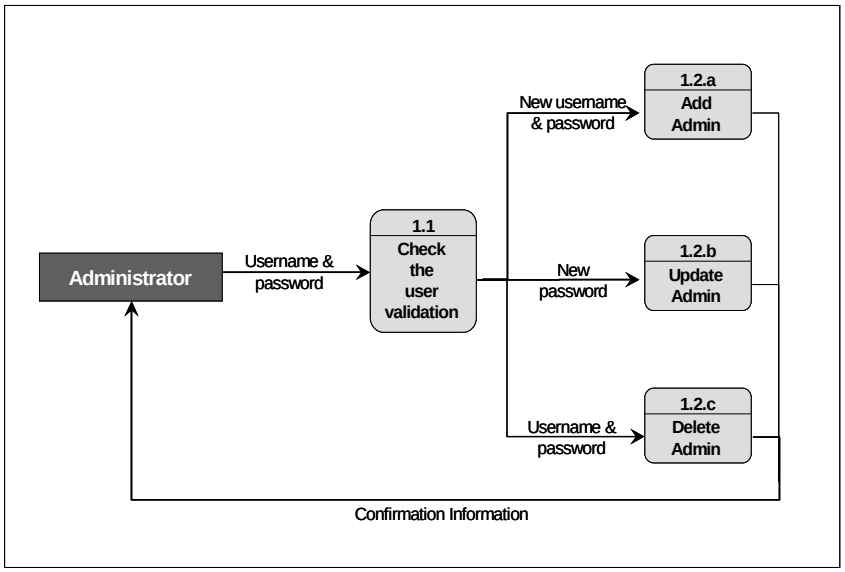

Figure 6.3: Level-1 DFD for process 1; administrating sub-system

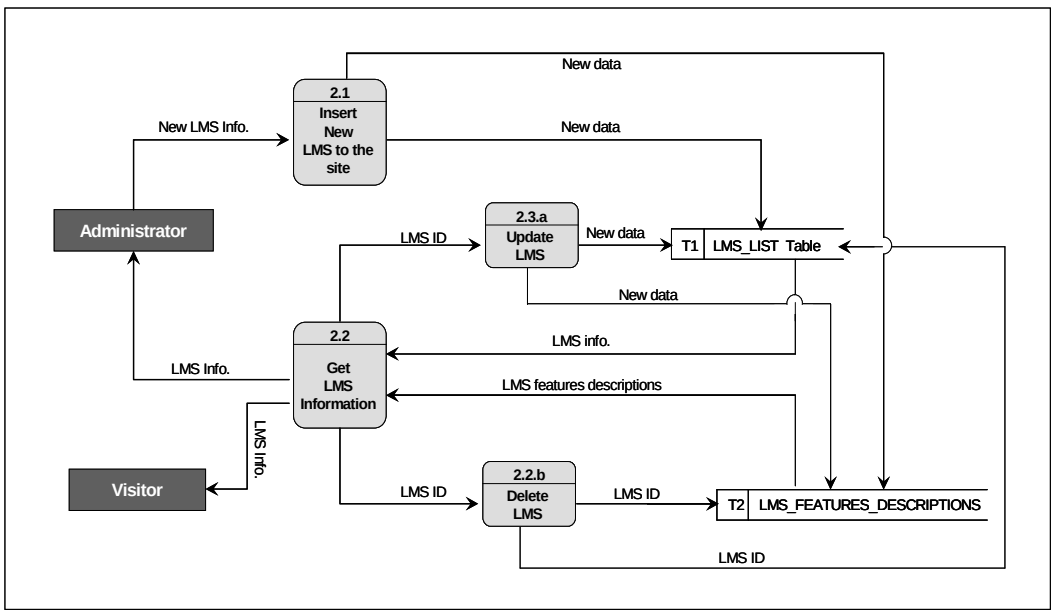

Figure 6.4: Level-1 DFD for process 2; managing LMS's sub-system

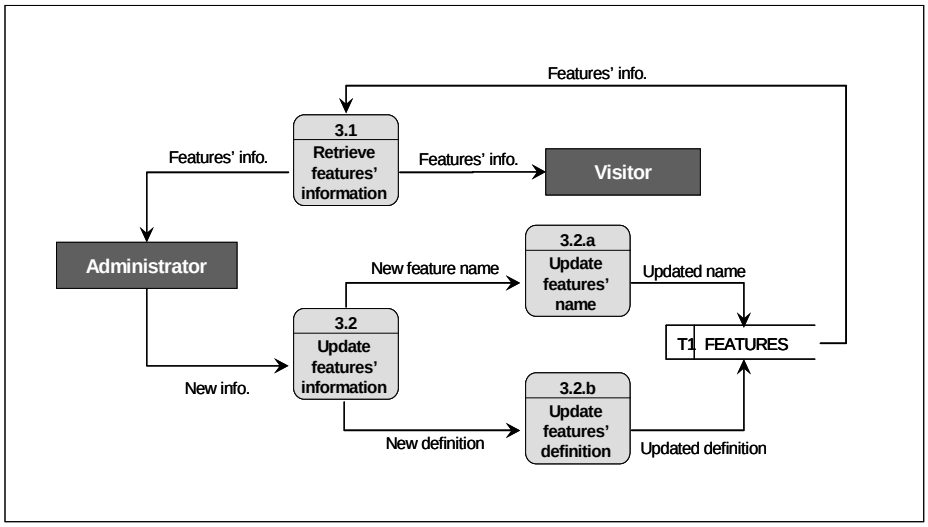

Figure 6.5: Level-1 DFD for process 3; managing features sub -system

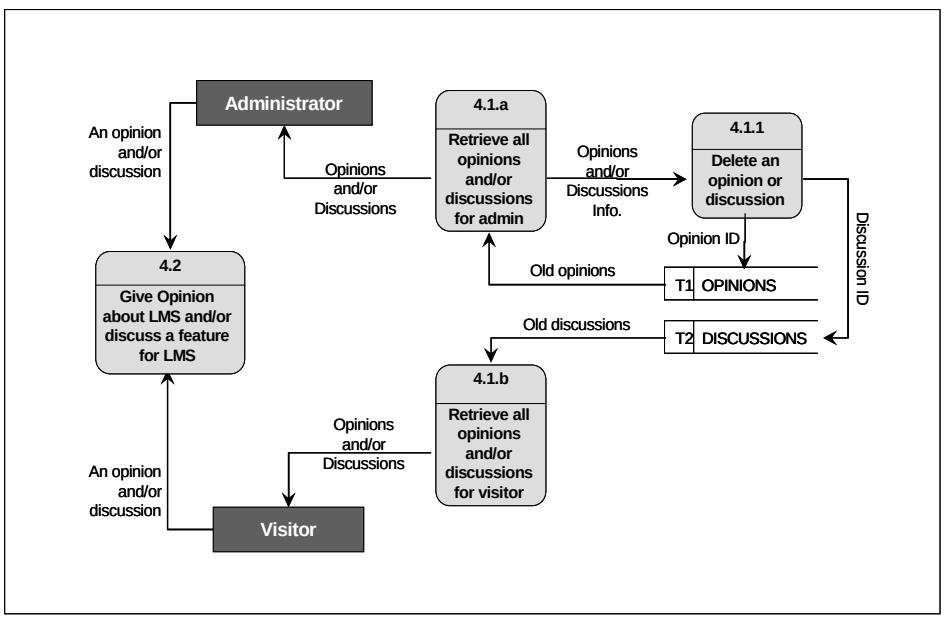

Figure 6.6: Level-1 DFD for process 4; opinions and discussions sub -system

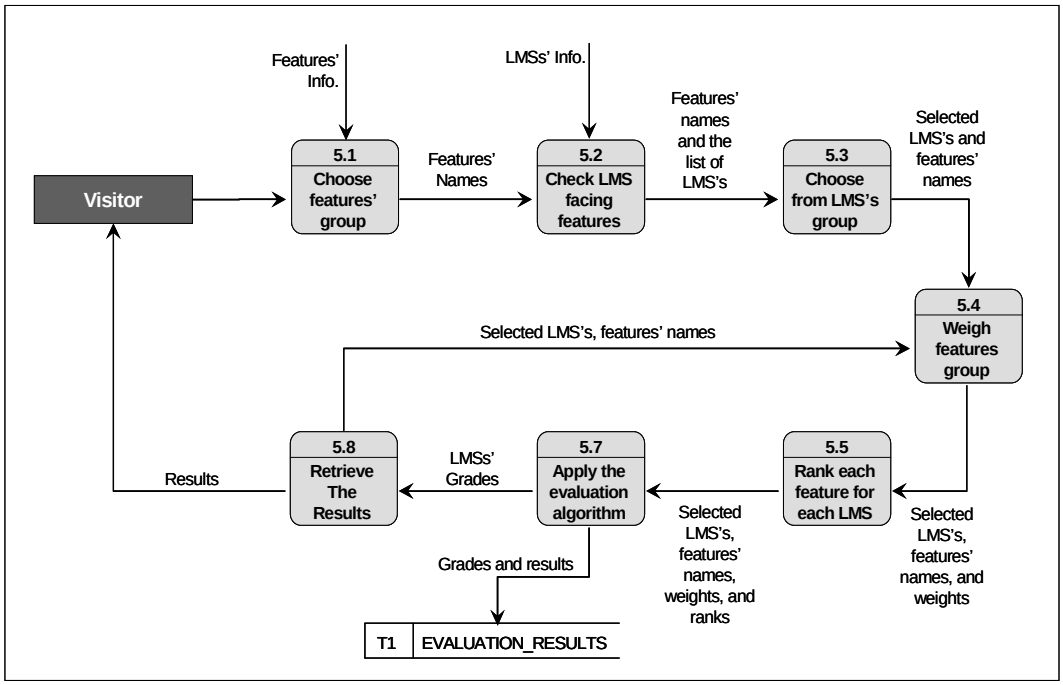

Figure 6.7: Level-1 DFD for process 5; LMS's evaluation sub -system

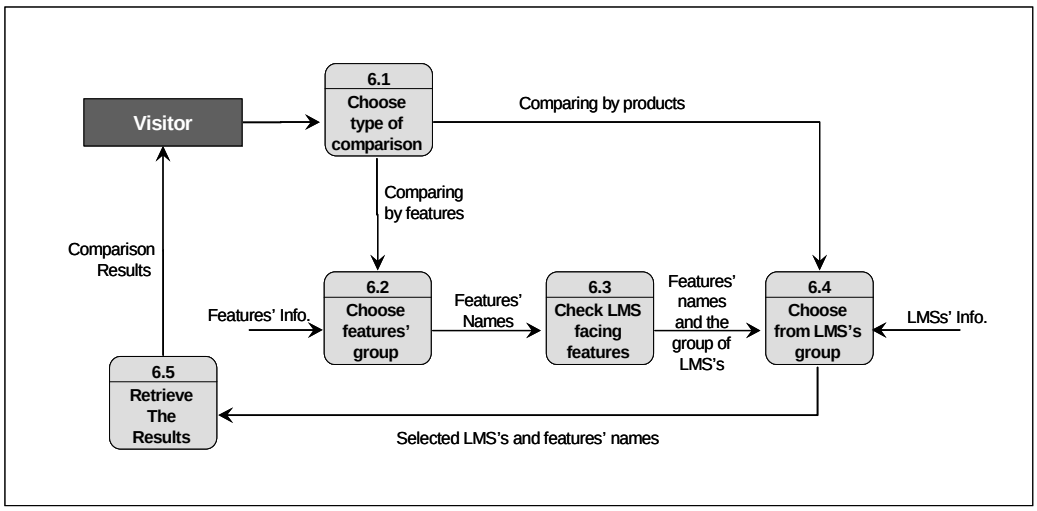

Figure 6.8: Level-1 DFD for process 6; comparing between LMS's sub -system

6.2.5 Database Design

This system will contain a database to store all LMSs' information and the data related to the evaluation and comparison operations. This database will contain nine (7) tables. We are using the Microsoft SQL Server 2005 to build this database.

Table 6.1: List of database tables

Table Name	Definition
ADMINISTRATOR	Storing all data related to the administrating team members and their accounts.
LMS_LIST	Storing the main information about the LMSs, such as, their names, software versions, companies, the developer names, and how to contact them.
FEATURES	Storing the list of features (which are 52) and a full description of each one of them.
LMS_FEATURES_ DESCRIPTION	Storing a description of each feature for each LMS and the administrator rank of each one of them.
OPINION	Storing the users' opinions about LMSs. The user should assign his/her level of experience in e-learning field. The administrator can add, remove, and manage the opinions space.
DISCUSSION	Here, the user can discuss and give his opinions about a specific feature for a specific LMS. The user should assign his/her level of experience in e-learning field. The administrator can add, remove, and manage the discussions space.
EVALUATION_ RESULT	Storing all the evaluation operation results, such as, the product name, it version, the admin advice, and grades for the results.

Table 6.2: List of fields for all database tables

Table Name	Field Name	Description	Data Type	Constraints
ADMINISTRATOR	USERNAME	Admin login name	NVARCHAR (50)	PK
	PASSWORD	Admin password	NVARCHAR (50)	
	REAL_NAME	Admin member's real name	NVARCHAR (100)	
	DATE	Date of registration	DATETIME	
LMS_LIST	LMS_ID	Product ID (sequenced no.)	INTEGER	PK
	NAME	Product's name	NVARCHAR (50)	
	VERSION	Product's software version	NVARCHAR (50)	
	COMPANY	Software company name	NVARCHAR (50)	
	URL	Company internet address	NVARCHAR (50)	
	DEVELOPER	Software developer name	NVARCHAR (50)	
	CONTACT_ DEVELOPER	How to contact the developer	NVARCHAR (1000)	
FEATURES	F_ID	Feature ID (form 1 to 52)	INTEGER	PK
	F_NAME	Feature's name	NVARCHAR (50)	
	DESCRIPTION	Feature's description or definition	NVARCHAR (4000)	
LMS_ FEATURES_ DESCRIPTION	LMS_ID	Product ID	INTEGER	FK, PK
	F_ID	Feature ID	INTEGER	FK, PK
	DESCRIPTION_ DETAILS	Description details of a specific feature relating to a specific product	NVARCHAR (4000)	
	ADMIN_RANK	The given rank by admin to a specific feature that relates to a specific product	DOUBLE	
OPINION	O_ID	Opinion ID (sequenced no.)	INTEGER	PK
	VISITOR_ NAME	Visitor's name (real name or nickname)	NVARCHAT (50)	
	USER_TYPE	Level of his/her experience	NVARCHAT (50)	
	MSG_DATE	Date of submitting the opinion	DATETIME	
	SUBJUCT	Subject of the opinion	NVARCHAT (100)	
	MSG_TEXT	The opinion message text	NVARCHAR (4000)	
	LMS_ID	Product ID	INTEGER	FK

DISCUSSION	D_ID	Discussion ID (sequenced no.)	INTEGER	PK
	VISITOR_ NAME	Visitor's name (real name or nickname)	NVARCHAT (50)	
	USER_TYPE	Level of his/her experience	NVARCHAT (50)	
	MSG_DATE	Date of submitting the discussion	DATETIME	
	SUBJUCT	Subject of the discussion	NVARCHAT (50)	
	MSG_TEXT	The discussion message text	NVARCHAR (4000)	
	LMS_ID	Product ID	INTEGER	FK
	F_ID	Feature ID	INTEGER	FK
EVALUATION_ RESULT	E_ID	Evaluation ID (sequenced no.)	INTEGER	PK
	USER_RESULT	The name of the product which takes the best grade in the evaluation operation, depending on the ranks given by the user.	NVARCHAT (50)	
	U_VERSION	The product's version for the user result.	NVARCHAT (50)	
	U_GRADE	The percentage grade for the best product depending on the user ranks.	DOUBLE	
	ADMIN_ RESULT	The name of the product which takes the best grade in the evaluation operation, depending on the admin ranks. It presents the administrator advice for the user.	NVARCHAT (50)	
	A_VERSION	The product's version for the admin result.	NVARCHAT (50)	
	A_GRADE	The percentage grade for the best product depending on the admin ranks.	DOUBLE	
	E_DATE	Evaluation operation date	DATETIME	
	FEATURES	An XML statement contains the features IDs included in the evaluation operation.	NVARCHAT (1000)	

Figure 6.9 shows the Entity Relationshi p Diagram (ER-D) of our database. It is designed by using the Microsoft Vision 2003 and copied from it.

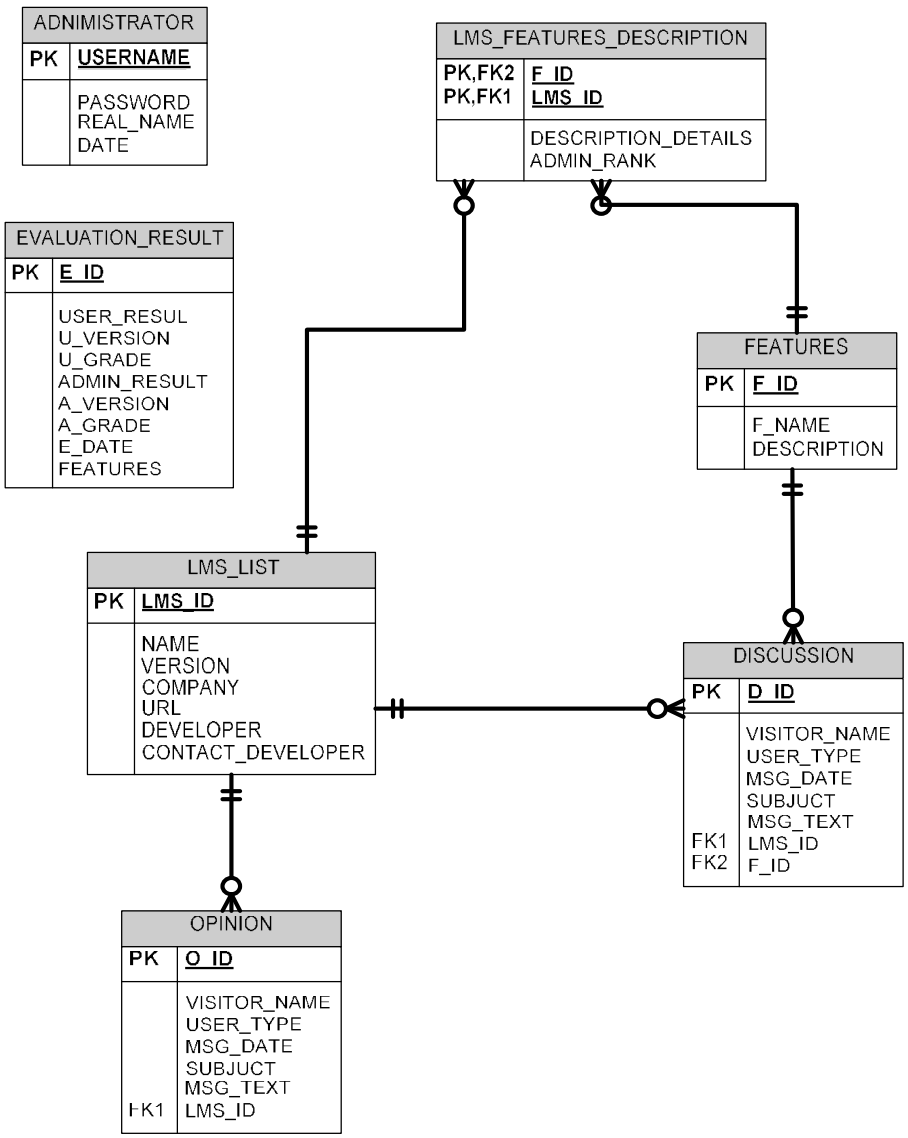

Figure 6.9: The ER-Diagram

6.2.6 Privileges and Responsibilities

The Use-case Diagram is one of the UML diagrams which show all activities of each user's type and their effects on the system's tasks. We used the Rational Ross software to design these diagrams.

6.2.6.1 Administrator:

The administration team is the responsible to administrate and manage the whole system tasks and processes. Figure 6.10 below shows the use-case diagram of all administrator activities in the system. Here, one can see how the administrator can affect on the system in the cases stated below:

1. Administrating all the system's tasks,
2. Adding new administration team members,
3. Updating any administration team members' information (their real names or accounts' passwords),
4. Deleting an administration team member,
5. Inserting a new LMS to the system,
6. Updating LMSs' information,
7. Deleting a LMS from the database and all its related information,
8. Describing list of features of each new LMS,
9. Updating LMS's information and/or their features' description,
10. Ranking each feature of each LMS,
11. Editing the list of all features and their definitions,
12. Managing the opinions given by the visitors,
13. Giving opinions about a LMS,
14. Managing the discussions given by the visitors,
15. Discussing a feature for a LMS.

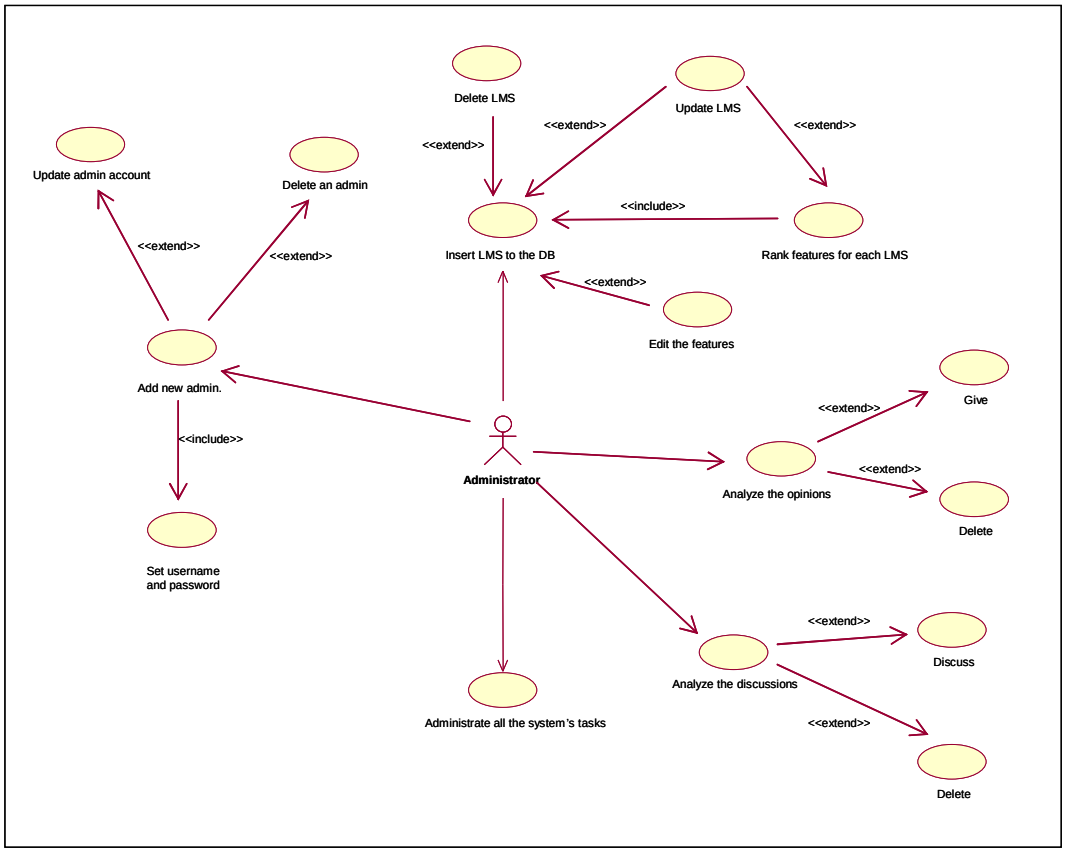

Figure 6.10: The Use-Case Diagram for Administrator

6.2.6.2 Visitors:

The visitor to our site can get benefits from the system through evaluating and making comparisons among the LMSs offered here. In figure 6.11, you will be aware of all activities of the visitors. Here, you can see how the visitor can affect on the system and benefit from the services offered to him/her in the cases stated below:

1. Viewing all products (or LMSs).
2. Making the evaluation process:
    a. Choosing the group of features depending on your needs,
    b. Seeing all LMSs that match your group of features,
    c. Viewing the administrator ranks of each feature relating to each LMS,
    d. Viewing a full description of each feature relating to product,
    e. Weighing each feature depending on your needs,

f. Ranking each feature of each LMS,

g. Getting the evaluation result,

h. Viewing the previous evaluation results.

3. Comparing between products:

   a. Full comparing of products of all features,

   b. Comparing a group of products with same features.

4. Giving an opinion about a LMS and reviewing the previous opinions given by the old users.

5. Discussing a feature of a LMS and reviewing t he previous discussions of old users.

6. Viewing the definition of each feature.

7. Viewing the feature's description of each feature relating to each product.

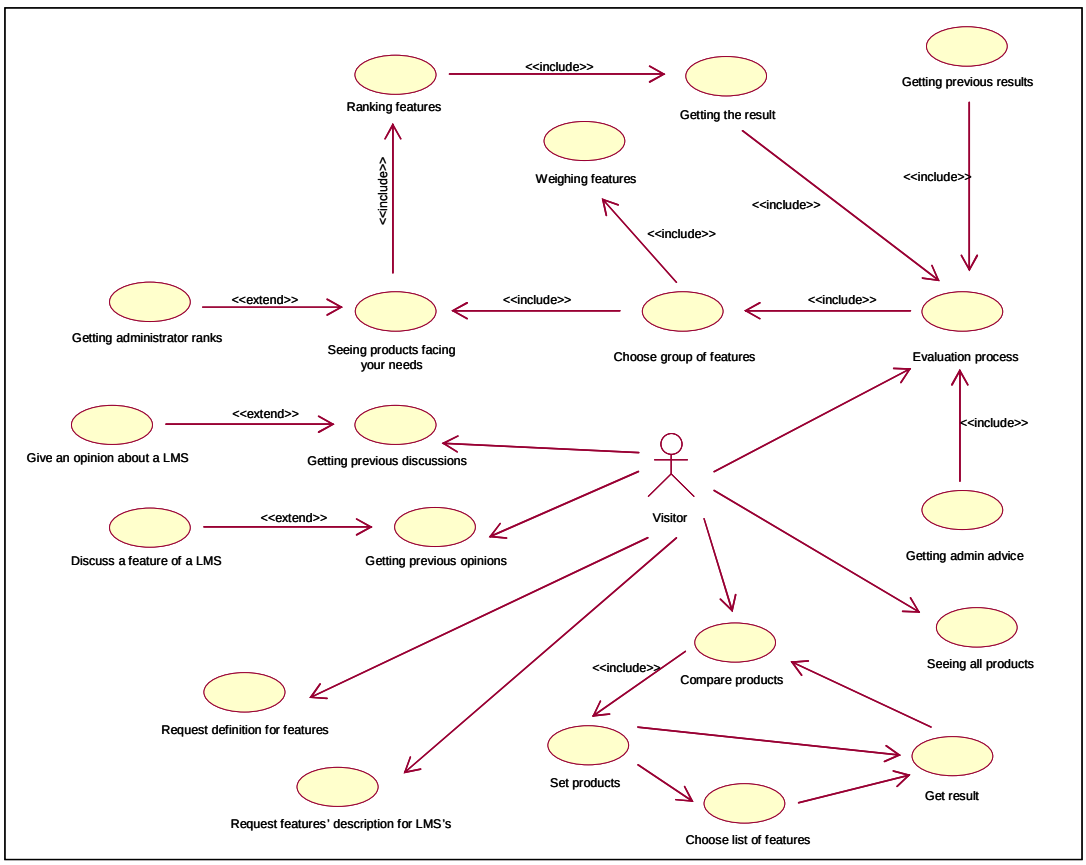

Figure 6.11: The Use-Case Diagram for Visitors

6.2.7 Application Programs and Programming Languages

In building this project I used some of application programs and programming languages as itemized hereunder:

6.2.7.1 Programming Languages:

1. Microsoft Visual Studio .NET 2005
    - Visual Basic .NET
    - ADO .NET
    - ASP .NET
2. HTML "Hyper Text Markup Language"
3. Dynamic HTML
4. XML
5. VB Script

6.2.7.2 Application Programs:

6. Rational Rose Enterprise Edition
7. Adobe PhotoShop
8. Microsoft FrontPage 2003
9. Microsoft PowerPoint 2003
10. Microsoft Visio 2003

6.2.7.3 Database Applications:

1. Microsoft SQL Server Management 2005

6.3 User Documentation (User Guide)

6.3.1 Introduction

This part of the documentation is the system's user guide. It contains a full description about all tasks in the system. Firstly, we have to know the main users who expected for our system. They will be one of the main use rs' types:

1. Administrators: the administrating team members for the site.
2. Visitors: the visitor user type may be one these types:
    a. Teachers,
    b. Students,
    c. Educational organizations (Universities, Schools, Institutes…).

This guide will present all the site's p ages for the administrators and visitors. Use the appendix A from this thesis to see all the screen shots for all web site pages.

6.3.2 The System's Home Page

In the screen shot (Figure A.1) it is obvious to see the home page of the site. It contains three main parts, the left menu, the right menu, and the body of the page.

1. *Left menu*: It contains three blocks: In this site, LMS's evaluation, and Comparing Products. Each block has some links as shown below:
    a. In this site menu, has these links:
        i. Home: go to the home page, where ever you are inside the site.
        ii. View all products: to view all products stored in the site, which they are 12 products (see figure A.2). Click on "Show details" button to see a full description about the product (see figure A.3). You can click on the feature's name to view the definition of this feature (see figure A.4).
        iii. Features glossary: the definition for the 52 LMSs' features included in the site (see figure A.5).

    b. LMS's Evaluation: the link will go with you to the LMSs' evaluation sub-system offered by this site (it will be discussed in section 6.3.4).

    c. Comparing Products, we have two types of comparison: by products and by features (it will be discussed in section 6.3.5).

2. *Right menu*: This menu contains two blocks.They are:
    a. The administrator login block (it will be discussed in section 6.3.3).
    b. Calendar.

3. *The page body*: It is the biggest part of the home page contains a general description about the project and some links to connect the site main parts. The most important links are:
    a. Link for features' glossary (see figure A.5)
    b. Link for the evaluation operation opinion (see section 6.3.4)
    c. Link for the comparing products option (see section 6.3.5)

    Also, this page offers a brief description about each LMS included in our project and a link to show their descriptions and their web sites.

6.3.3 Administrator Pages:

As known, the administration sub-system is the most important part for any web-based system. So, in the following, we are going to represent and describe the administrator tasks in our system. It presents how the administrator can manage his/her account and other administrating accounts and how to manage the list of all LMSs and the related tasks for that. Our system has a complete administration sub-system. If you are an administrating member, you can log-in to your page by typing your username and password from two main places:

1. from the block in the right menu of the home page (see figure A.6),
2. Or from the login page (login.aspx). See the screen shot in figure A.7.

For more security, if any one tries to write any page address related to the administrator in the address bar, the system will appear the log-in page shown in the figure A.7. Also, when the administrator is logging-out from the admin page, the system will appear the log-in page again. No one can enter the administrator page without typing a correct and valid username and password.

6.3.3.1 Administrator Main Menu:

After logging-in to the administrator page, you can be able to access the main menu of this page which contains four (4) main options; each one has some links for each administrator activity. See figure A.8 and table 6.1 below:

Table 6.3: Administrator main menu options

Administrators' Accounts	Add new admin Update your account Delete admin
List of all products	See a list of all products Add a new product Update a product Delete a product
Opinions and Discussions	See and give opinion See and discuss
Edition features	Change features information

Now, we will show each screen's tasks to each command as above stated:

6.3.3.2 Manage administrator's accounts:

Any administration team member should have a valid username and password to access the admin page. He/she can register for a new administration team member, update his/her real name or password, and delete an administration account. All these three tasks are secured and should be done by a valid administrator only.

- *Add new administration team member (see figure A.9):*

  We should enter the real name for the admin member, a unique username, and password in two fields to confirm it. There is no two members have the same username.

- *Update your account (see figure A.10):*

  You can edit your real name, or change your password by typing the old password and a new one which you want. Here, you should confirm the new password by typing it again in the confirmation field.

- *Delete an administrator (see figure A.11):*

The responsible for deleting any administrator is the administrator himself. You can delete an admin member by choosing his/her username from the DropDownList which founded in the form for deletion, and then typing its password.

All the tasks above are too much secured and no one can do them expect the administrator. And all the queries related to them are stored procedures inside the SQL Server and no one can access or edit them or the database at all.

6.3.3.3 Managing the list of all products:

- *View all products' list (see figure A.12):*

This command allows the administrator to check the complete list of all LMSs, or products, stored in the system's database. By clicking on "Show details" button, he/she can view a full features' description for the product.

- *Adding New Product to the System (see figure A.13):*

Only the administrator can insert, update, or delete a LMS to or from the system's database. The administrator should enter the information in three parts as follows:

1. The general information about the products. It will contain:
   - The product's name,
   - Its software version,
   - The company name which produced the system,
   - Software developers,
   - How to contact the developers.

2. The features' description for each feature included in the product. As we know, the total number of features is 52. The administrator should enter only the descriptions for the features founded in the product.

3. The administrator ranks fields: the administrator should enter his/her rank for each feature founded in the product inserted in the previous point. The rank will start from 0 to 1. We used here the fuzzy ranking to evaluate the efficiency for the product in a specific feature. Also here, we have 52 fields. The ranking degrees will be as follows (0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1)… "0" if the system hasn't this feature. "1" if the system completely has this feature and with the best efficiency.

- *Update a product (see figures A.14 and A.15):*

By clicking on the "Update a Product" link, the list of all products will be appeared (see figure A.14). The administrator can click on "Update" link from the table in order to change any entry as needed from the three parts of the second screen in figure A.15 (the general product's information part, the features' description part, and the administrator ranking part).

- *Delete a product (see figure A.16):*

By clicking on the "Delete a Product" link, the administrator can see the list of all products; he/she can delete any product from the database by clicking on the "Delete" link in the table. Answer the question "Are you sure you want to delete this product?" by "Yes" answer in order to delete all product's information and all related data in the database.

6.3.3.4 Opinions and Discussions:

- *View Opinions (see figure A.17 and A.18):*

This option will order you to select the product name and its software version in order to view all the opinions were given about it from the users (see figure A.17). Also, the administrator can type his/her own opinion about the product or give a comment on any opinion (see figure A.18). All the opinions given by the administrator will be shown for the user with "ADMIN" visitor name in capital letters. The administrator can delete any un-desirable opinion by clicking on "Delete" link placed in the table (see figure A.18 also).

- *View Discussions (see figure A.19 and A.20):*

This option will order you to select the product name, its software version, and the feature's name you want to check in order to view all the discussions were given about it from the users (see figure A.19). Also, the administrator can discuss any feature for a product or give a comment on any discussion (see figure A.20). All the discussions given by the administrator will be shown for the user with "ADMIN" visitor name in capital letters. The administrator can delete any un-desirable discussion by clicking on "Delete" link placed in the table (see figure A.20) also.

6.3.3.5 Edit LMS's Features:

The administrator can edit the features' description by typing new name or definition for a feature from the features list (see figure A.21). Each feature from the 52 features has an "Update" button to update its entries.

6.3.4 The LMS's Evaluation Sub-System:

This is the most important part in our project that shows our goal of this thesis. It is to evaluate the LMSs. The evaluation sub-system contains five (5) steps which are smart and easy to use by any user type.

To start your evaluation, go to LMS's Evaluation block from the left menu and click on the link placed there (return to section 6.3.2) or go to the evaluation option link which is placed in the body of the home page (see figure A.1). This link will connect you with the first page of the evaluation operation (see figure A.22 and A.23). Click on "Start an operation" button to start the evaluation operation. Below we are going to show these five steps and a brief description of each one:

- *Step 1: selecting your needs (see figure A.24):*

This step will present the 52 LMS's features stored in the site and ask you to choose the group you want to be in your LMS looking for. Click on the feature's name to view the feature's definition (see figure A.4). You can choose from 1 to 52 but not less than one by selecting the Chick_Boxes. Click on "Next Step" button to go to the next step.

- *Step 2: choosing the group of products you want to include in your evaluation operation (see figure A.25):*

  This system will check the list of all products and can recognise the one that matches your needs and your group of features selected in step 1. You can choose all the products appeared or some for them, but not less that one. Click on "Show Details" link in the table the view a full description of each product (see figure A.26). Click on "Next Step" button to go to the next step.

- *Step 3: Weighing you group of features (see figure A.27):*

  Here, you have to weigh each feature from the group of features you have already chosen in the first step. Your weights will be depending on your amount of need to each feature. The weights will start from 1 and end by 0. Also, by clicking on the feature name, you can see the definition of the feature (see figure 28). Click on "Next Step" button to go to the next step.

- *Step 4: Ranking each feature for each product (see figures A.29 and A.3 2):*

  In this step, you have to be careful about your ranks. You have to clearly understand what the feature name means, click to the feature name to see the feature definition (see figure A.28). Also, you have to clearly understand the description of each feature in each product; the "Features' Description" link will help you in seeing a full description for each feature included in the operation for the product (see figure A.30). You can see in this page, the administrator rank. The administrator was ranking the features for each product depending on high level of experience. You have to use the DropDownList placed in the table for each feature to enter your rank. You can see all opinions were given about each product (see figure A.31) by clicking on the opinions link placed in the table. Now, click on the "Calculate and Get Results" button to view the results page.

- *Step 5: The results page (see figures A.3 3 and A.34):*

  This is the results page. Here, you can see all the results needed from the evaluation operation you made. This page will show you a group of results such as:

1. First table shows you the group of products entered the operation, their versions, and the grade of each one. You can also see the details of each product by clicking on details link.
2. Second block is to show the product's name, version, and the grade of the product that takes the best grade. This result depends on the weights and ranks you have given in the step 3 and 4.
3. Third bock is to show the product name, version, and the grade of the product that takes the best grade depending on the administrator's given ranks. This result presents the administrator advice depending on his/her high level of experience.
4. At the end, there is a table shows a brief summary about the old evaluation operations done by other users with the same group of needs or features. The products shown here took the best grade after applying the evaluation depending on the ranks given from the users. The table presents the product name, its version, the number of selecting the product, and the date of the last operation.

At the bottom of the page (see figure A.34), you can see clearly three links:

a. "Give new weights and ranks for this operation", this link will go with you to step 3 and 4 (see figures A.27 and A.29) to give new weights and ranks for the same group of features and products.
b. "Start new operation", this link will go with you to step 1 of the evaluation operation to re-start new one (see figure A.24).
c. "Return to the home page", to return you to the home page of the site.

6.3.5 The Comparing Products Sub-System:

It is a smart service to make comparison between products. The comparison will be shown by representing the features' of all products included in the comparison operation. The comparing service is offered in two types of comparisons:

1. Comparing between products depending on the products' names.
2. Comparing between products depending on a group of features.

Form the left menu, click on the (By products) link to activate the comparison depending on the products' names or click on (By features) link to activate the comparison depending on a group of features. Also from the home page (figure A.1), you can use the comparison link placed in the body of the page to start the operation. To start new operation, click on the comparison link in the home page then figure A.35 will appeare. It will give you a brief description about each type of comparisons. Hereunder, we are going to discuss each one:

1. *Comparison by products:*

   You have to choose a group of products you like to compare from the table of all products placed in figure A.36, click on "Compare between these selected products" button in order to view the results in the results page (see figure A.37). The results page has two tables; the first one shows general information about the products included in the comparison. You can see all opinions that were given about each product and give a new opinion by clicking in "Give opinion" link. The second table shows a complete description of each feature of all products in the operation.

2. *Comparison by features:*

   You have to select firstly the group of features you want to compare the products with (see figure A.38). Then, the system will check which products are facing these features (see figure A.39), choose a group of products you like to compare from the table. After that, click on "Compare between these selected products" button in order to view the results in the results page (see figure A.40). The results page has two tables; the first one shows general information about the products included in the comparison. You can find all opinions that were given about each product and give a new opinion by clicking in "Give opinion" link. The second table shows a complete description of the features selected in first step comprising all products in the operation.

6.3.6 Opinion and Discussion Sub-System

These two services are important to the visitor to view the other visitors' opinions about a product or their opinions about a specific feature of a product. It looks like a discussion forum on the site.

6.3.6.1 Give your opinion about a product

This service lets the user give his/her opinion about a specific product and enables to see all opinions that were given by other visitors. In each opinion, you can see the level of user's experience because the experience is very important factor in building any opinion about anything. Figure A.4 1 shows an opinion page for one of the products .This could be obtained by clicking on the give opinion link from the products details page in figure A.3.

The opinions with the visitor's name (ADMIN) in capital letters are given by the administrator. No one, expect the admin, can enter the name (ADMIN) with capital letters (for more information about the administrator view-point, return to section 6.3.3.4). One who wants to give an opinion shall enter his/her name or nickname, the level of his/ her experience, the subject, and the opinion text.

The level of experience is classified to five levels:

a. Expert in LMS fields,
b. LMS Administrator,
c. End-user for a LMS,
d. Looking for getting a LMS,
e. Normal visitor of our site.

6.3.6.2 Discuss a feature of a specific product

This service lets the user discuss and give his/her opinion about a specific feature of a specific product and enables to see all discussions given by other visitors. In each discussion, you can see the level of user's experience because the experience is a very important factor in building any opinion about anything. Figure A.4 2 shows the discussion page on one of the products. This could be obtained by clicking on the "Discuss" link from the products details page in figure A.3.

The discussions with the visitor's name (ADMIN) in capital letters are given by the administrator. No one, expect the admin, can enter the name (ADMIN) with capital letters (for more information about the administrator view -point, return to section 6.3.3.4). Anyone who wants to discuss any feature of a product shall enter his/her name or nickname, the level of his/ h er experience, the subject, and the discussion text.

6.4 Summary

This chapter is to document the web -based system stated in this thesis. It is divided to two main parts; technical documentation and user documentation. The technical documentation part pre sents the SDLC of the system through analyzing and designing phases. The user documentation part presents the user guide lines the method of how the user can use this system. Appendix A provides all the screen shots needed to understand how to use the syst em.

Chapter 7

CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

Because of the huge amount of e-learning systems; LMSs or CMSs, offered yearly over the web and because of this rapid development in learning technologies over the world, we are now in insisting need to define or develop some tools to evaluate the quality, efficiency, and performance of this development.

The biggest problem facing the user of LMSs is how to choose a system that can meet the needs raised. In this case, our job will be focused on how we can find a technique which is capable to facilitate the operation of selection and also how we can make it stricter than before in some computerized solutions.

In order to solve this problem, we primarily must think of how we can find standard criteria to evaluate the whole LMSs. We dicussed formerly the general features of every e-learning system and defined 52 features to be our criteria in the evaluation operation, (see chapter 4).

The features are classified to six main factors as follows:

1. Pedagogical factor,
2. Learner environment,
3. Instructor tools,
4. Course and curriculum design,
5. Administrator tools,
6. Technical specification.

To take some of the LMSs to be our study field in this thesis, we formerly included the most famous five LMSs available over the web: Moodle, ATutor, Blackboard, WebCT, and Claroline, and also included some of their versions in

our research (refer to chapter 5). As mentioned before that these products are widely-used in the educational organizations over the world. Taking into consideration that we included the two major types; the open source and the commercial systems and also made a huge research over these systems in order to find the most important characteristics of each feature existed in the 52 features mentioned before (see appendix B).

Our system has some limitations like the number of LMS s presented and the number of the evaluation criteria. There are fifty two features available for twelve LMS and the number of features can be increased according to the f uture limits of work. This will make the evaluation better than it is now. In addition, we can add any new LMS to our database in an easy way (discussed in chapter 6 section 6.3.3.3)

So as to develop an algorithm for evaluating these LMSs, we applied the *Linear Weighted Attribute Model* and developed and applied it in our project to be the general technique in evaluating the LMSs. This kind of models is called *multi-attributes decision making*. Linear Weighted Attribute Model consists of two main categories. They are weight and rank; *weights* for each feature in the evaluation operation and *ranks* for each feature in each LMS included in the operation, and both of them take the fuzzy valuates as their frequency. It is a smart algorithm and easy to use by the end-user. Its five steps were discussed in chapter 3.

This thesis and its web-based project could be cosidered as a practical and useful solution to the problem. Thus, performing any evaluation operation to any group of LMSs based on some features you need becames easier and understandable. It is also possible to make a lot of comparison operations among the LMSs depending on their features' descriptions, giving the opinion or the viewpoint about any LMS or even discussing any feature of any LMS offered in t he system, regardless of the level of your experience: expert, administrator, end-user or anyone else. This system was designed and programmed by using the MS-Visual Studio .NET and its database was designed by using MS-SQL Server .NET (refer to chapter 6).

As mentioned in chapter 2, a web-based computerized tool named EduTools (http://www.edutools.com/) was found out in order to evaluate the LMSs and CMSs over the web. It is a web-based decision making tool that can evaluate and compare the LMSs. After testing this tool many times, it was noted that this system is enriched with some additional services and new upgraded ideas. In the following points, I am going to explain some of the practicality and effectiveness of this system and some comparisons between it and the EduTools:

1. Our system offers a fixable Graphical User Interface (GUI) which it is easy to be used by any type of users or visitors.
2. EduTools offers 42 features of LMSs. We merged some of them in one feature and added some new others. Our system offers now 52 features as criteria in evaluating and comparing the LMSs (see chapter 4).
3. The system uses the fuzzy values to weigh and rank LMSs' features, but EduTools uses the integer values which it is not limited.
4. Limited weights and ranks values offer us a percentage results out of 100, which is better than EduTools' method in scoring.
5. Weighing method of features is independent. This means that you can enter the degree of your need to any feature separately. In EduTools, they weigh each feature depending on its importance and weight in cumulative structure which is a confused technique to the user.
6. This system provides the user with new results as the Admin Result, for example. It is the administrator's view based on the group of features which were selected and the ranks which were given by the administrator according to his experience. It is, in particular, a very useful result that could guide new users to the LMSs. The other result is that the number selections of each LMS included in the system depends on the same group of features which are chosen by the user for the evaluation operation.

This thesis and its project are assigned to anyone interested in the e-learning field and its evaluation. The most important individuals involved in our research are

teachers, students, and educational organization such as: universities, schools, institutes, or anyone who looks for a proper LMS that exactly suits his demands.

7.2 Recommendations

For performing a good evaluation with best results, one has to pro vide the system with what he/she exactly needs from these LMSs. Below, there are some of these demands:

1. Choosing the specific features group from the whole features list offered by the system depending on your urgent need to the system.
2. Weighing each feature chosen, showing how much this feature is important to be included in your LMS that you seek.
3. Proper ranking of each feature relating to each LMS through a careful reading of the descriptions given to you by the system. Such rank will be as an evaluation grade given by you to the LMS on a specific feature: how it works, how it is efficient and performing, and how it suits your needs.

7.2.1 Future Research

Our system works now with a very high efficiency. One of our future aims is to make this system available over the web and to be in the hands of anyone wishes to benefit from our services. This will require from us to supply more LMSs or products to enrich its database and to furnish the system with the latest and updated versions of each LMS stored in the system, in addition to the fit description which should depend on the features ' criteria stated before. It is also beneficial to look for more specific and sensitive new features to include in our evaluation criteria. This needs to create updating to t he system's design to make it more flexible and responsive for either adding or removing features. Adding some results to the evaluation results' page or to the comparison results' page are future activities that should be studied very well. Other fut ure efforts will be focused on updating the opinions and discussions sub -system by adding some rooms to this forum and also adding some online journals, as well.

In order to globalize our project and make it widespread, and to access the most number of users over the world and attract them to benefit from our services, we will think of adding some languages to our user interface. Accordingly, the visitor to our home page can choose any language that suits him/her from the list of available languages in the system.

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APPENDICES

APPENDIX A

THE SCREEN SHOTS CAPTURED FROM THE EVALUATION SYSTEM OFFERED BY THIS THESIS

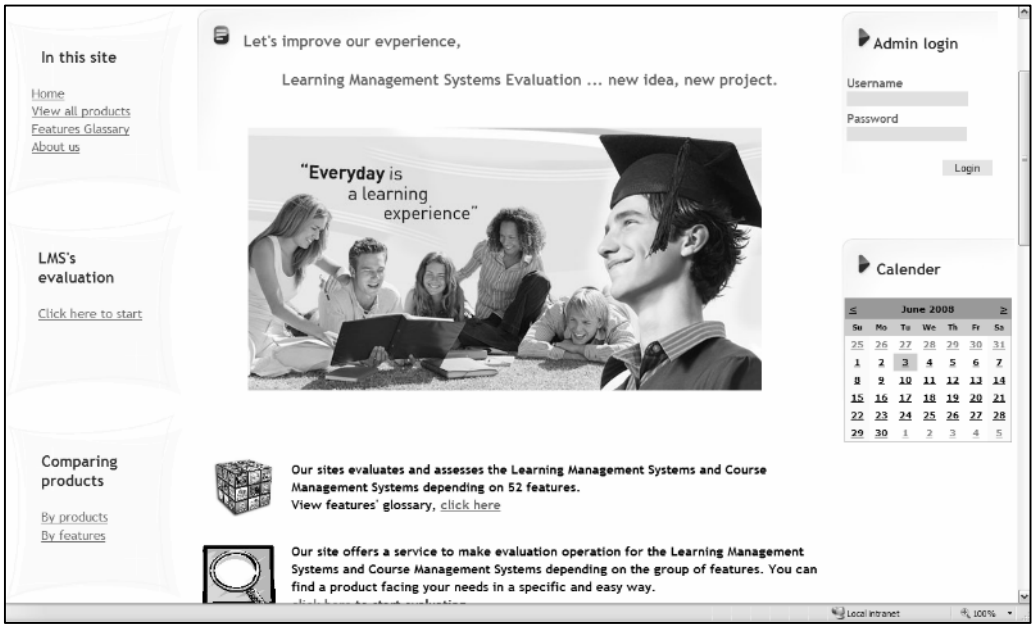

Figure A.1: The Home Page of the site

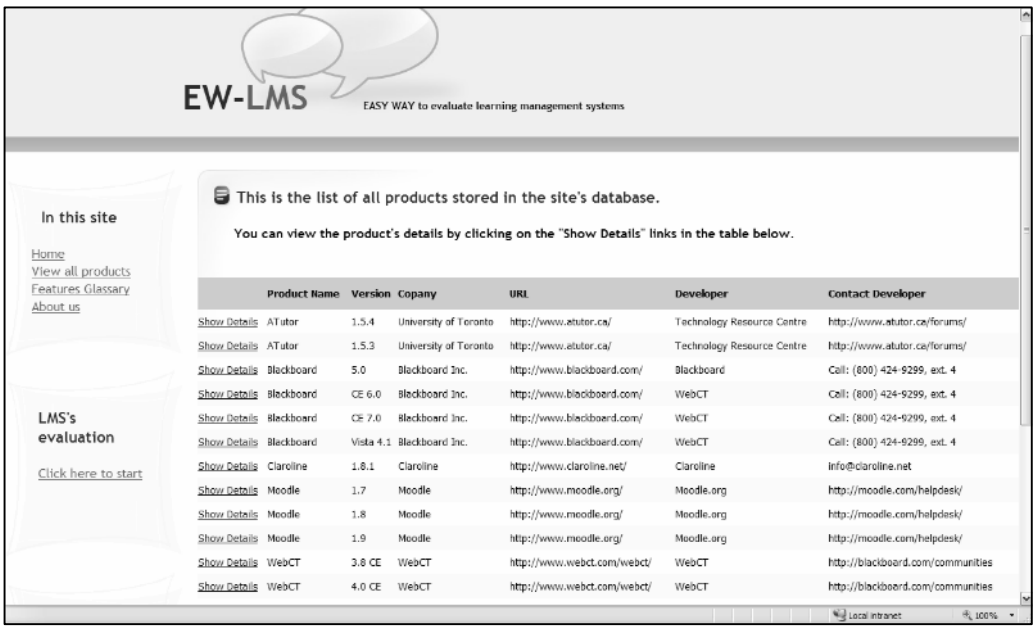

Figure A.2: List of all products' page

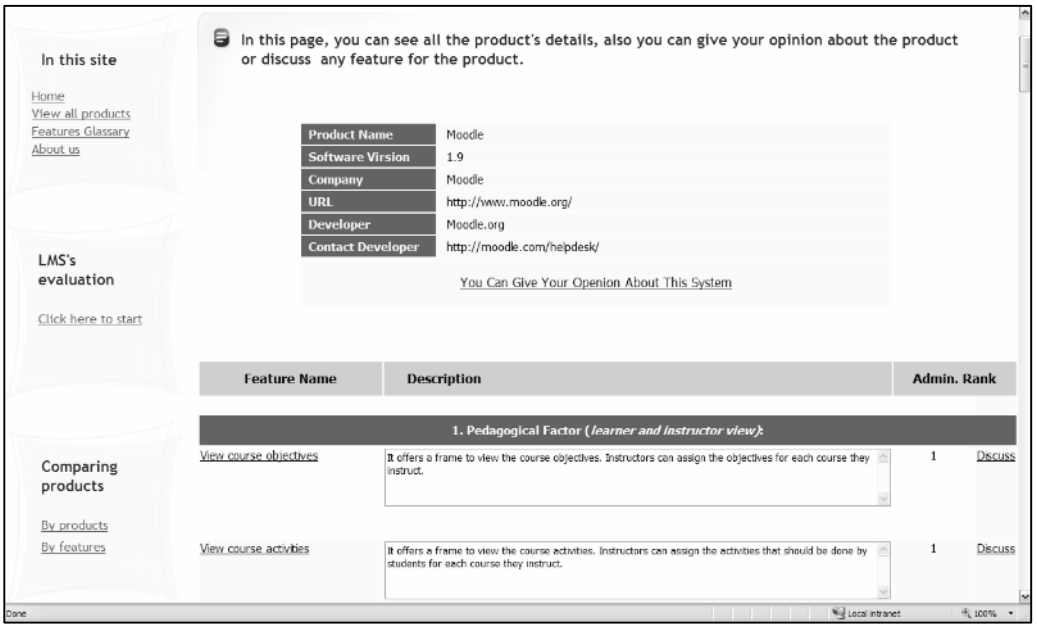

Figure A.3: Features' description of a product

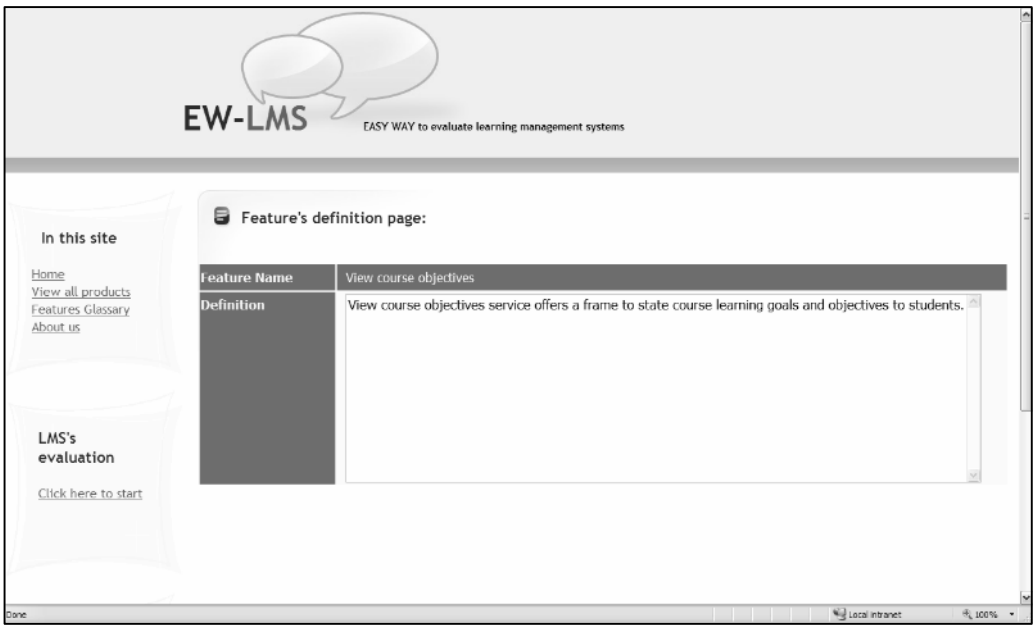

Figure A.4: Feature's definition page

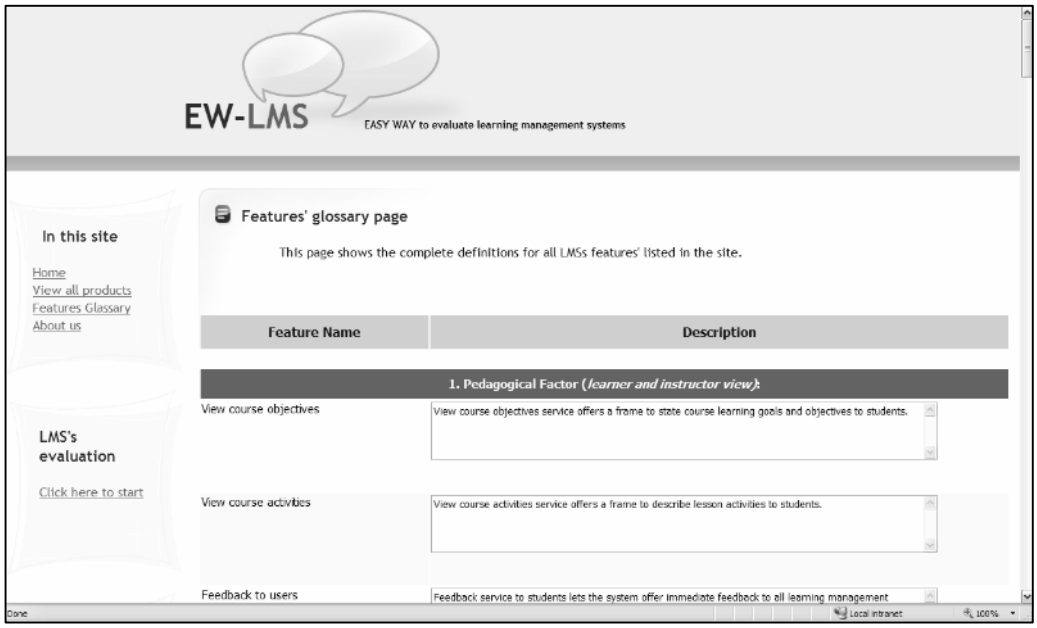

Figure A.5: Features' glossary page

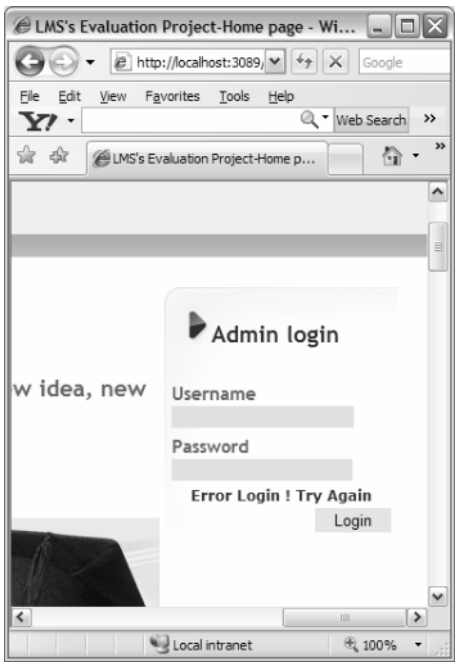

Figure A.6: Administrator right-menu log-in block

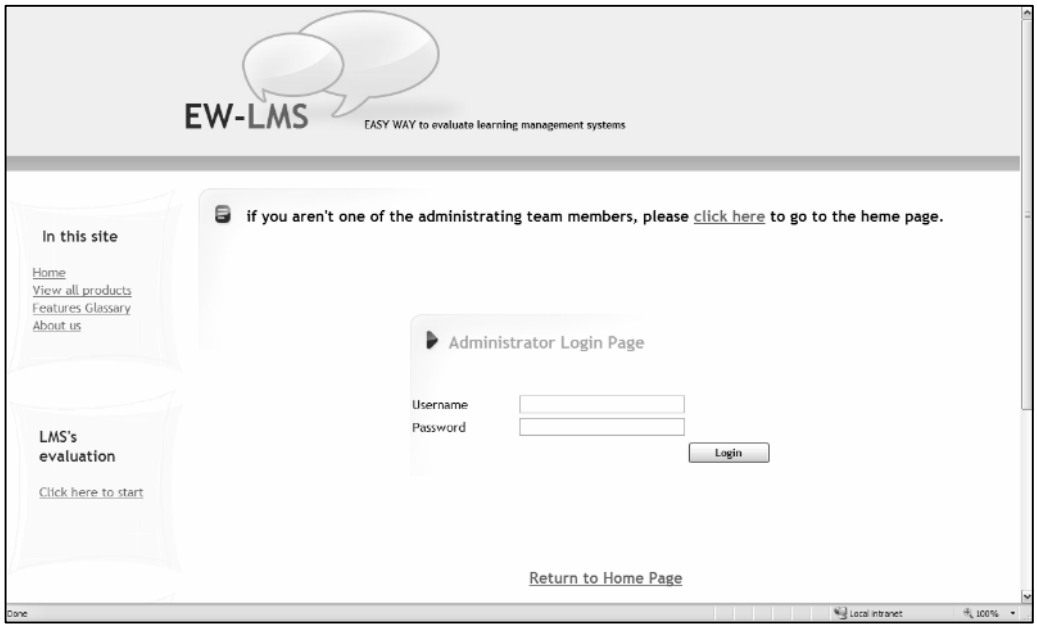

Figure A.7: Administrator log-in page

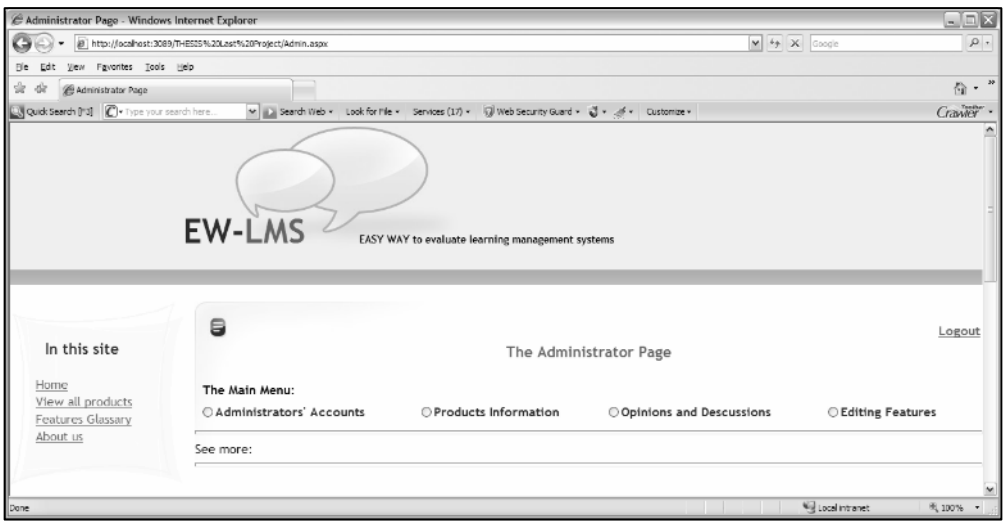

Figure A.8: The main menu of administrator page

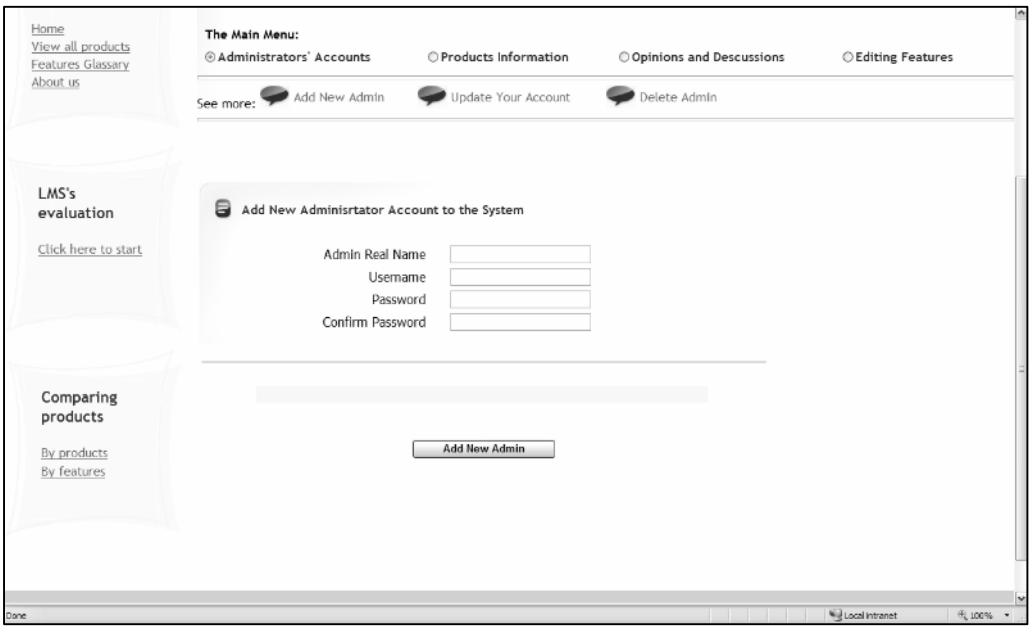

Figure A.9: Adding new administrating member's block

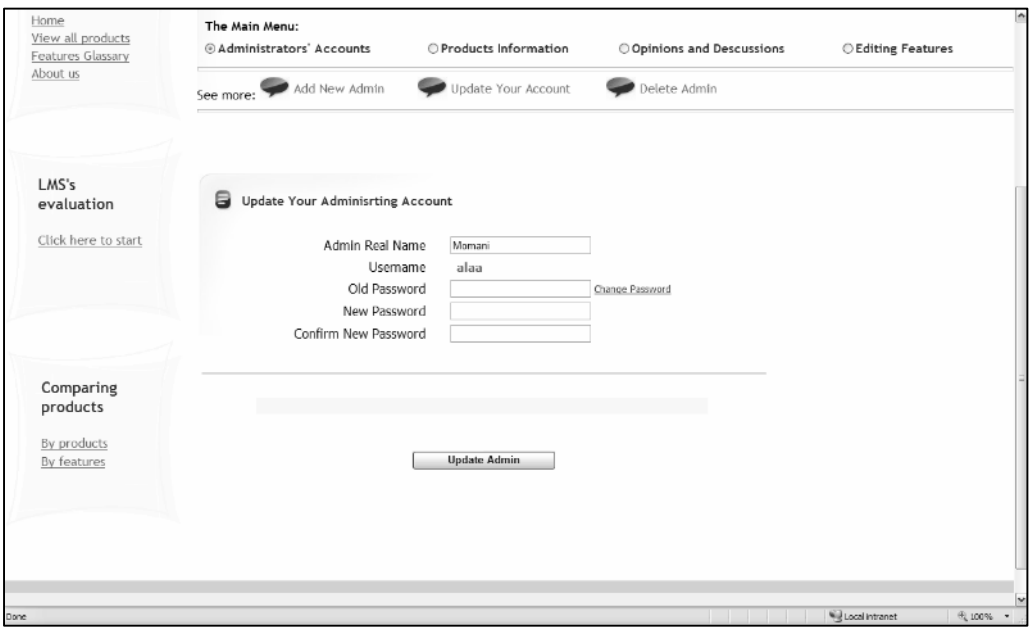

Figure A.10: Updating your administrating account's block

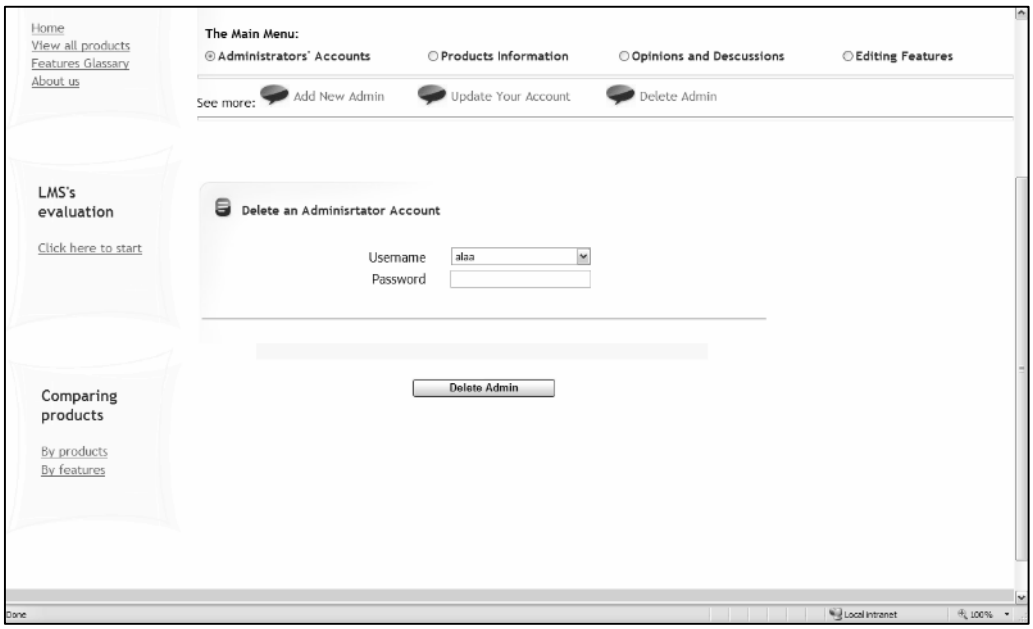

Figure A.11: Deleting an administrating member account's block

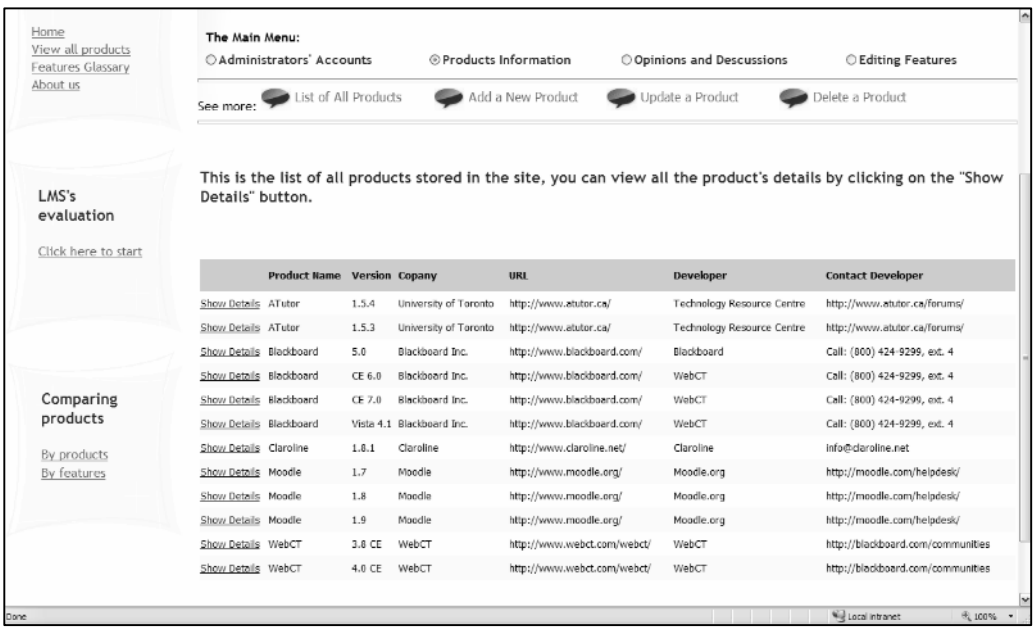

Figure A.12: List of all products of administrator

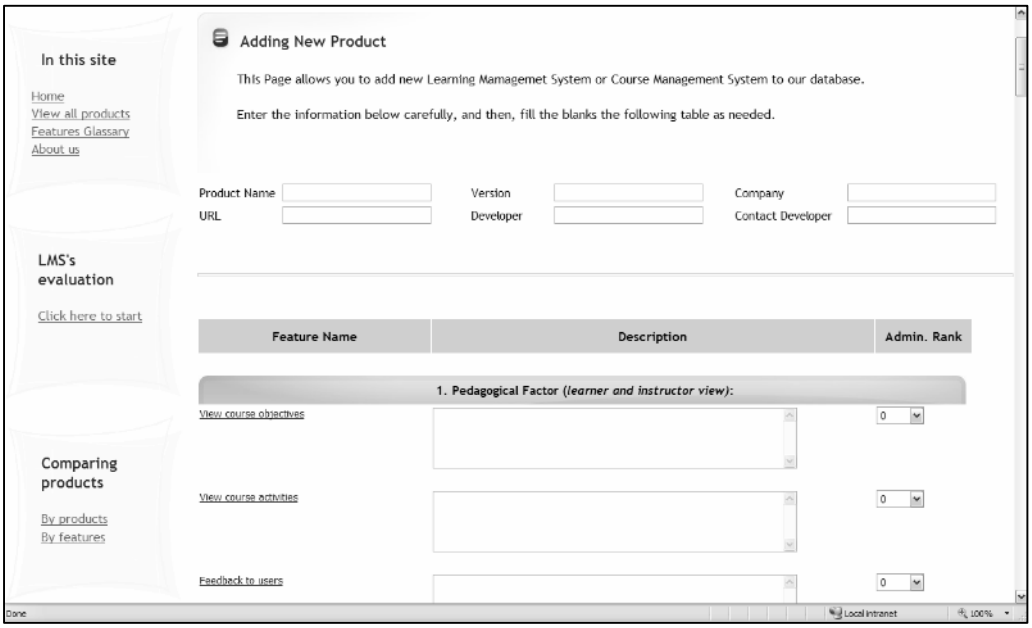

Figure A.13: Adding new product form to the system

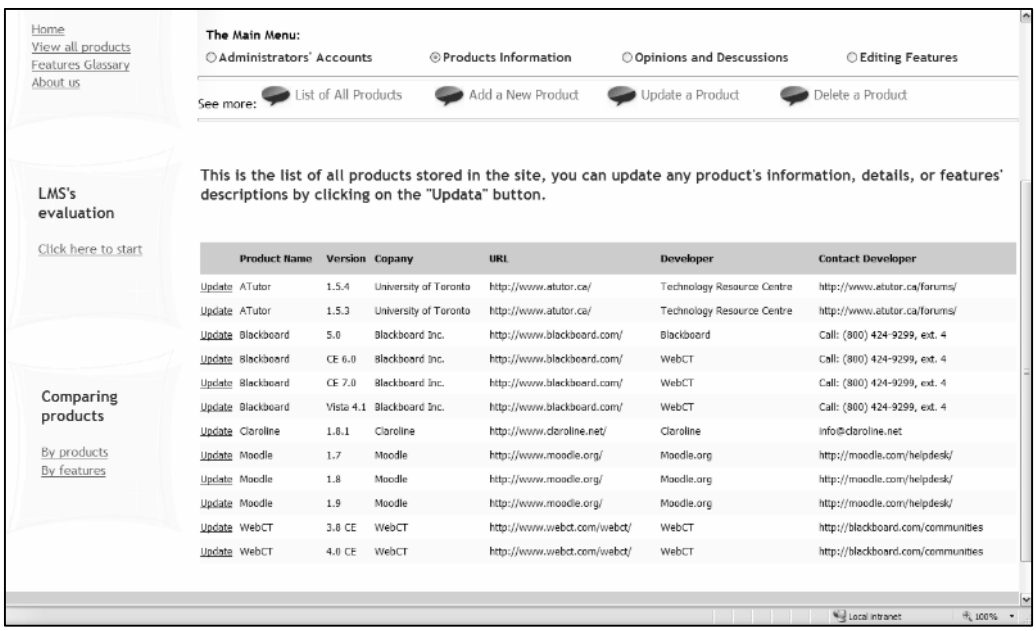

Figure A.14: List of all products for updating one of them

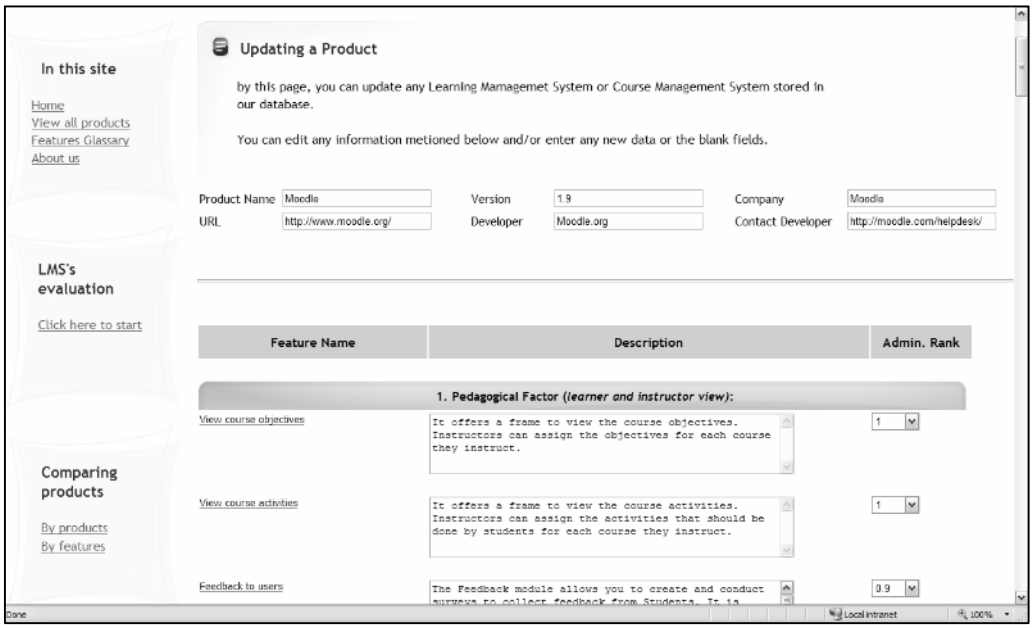

Figure A.15: Updating products' page

Figure A.16: Deleting products' page with the confirmation message

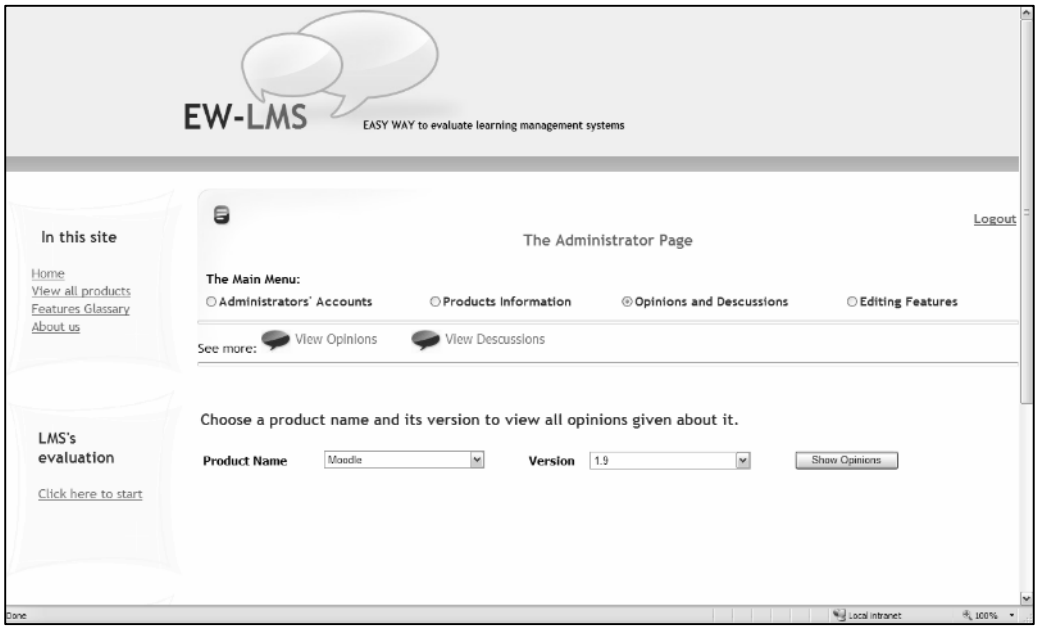

Figure A.17: Choosing a product and its software version in order to show a list of all opinions given about it

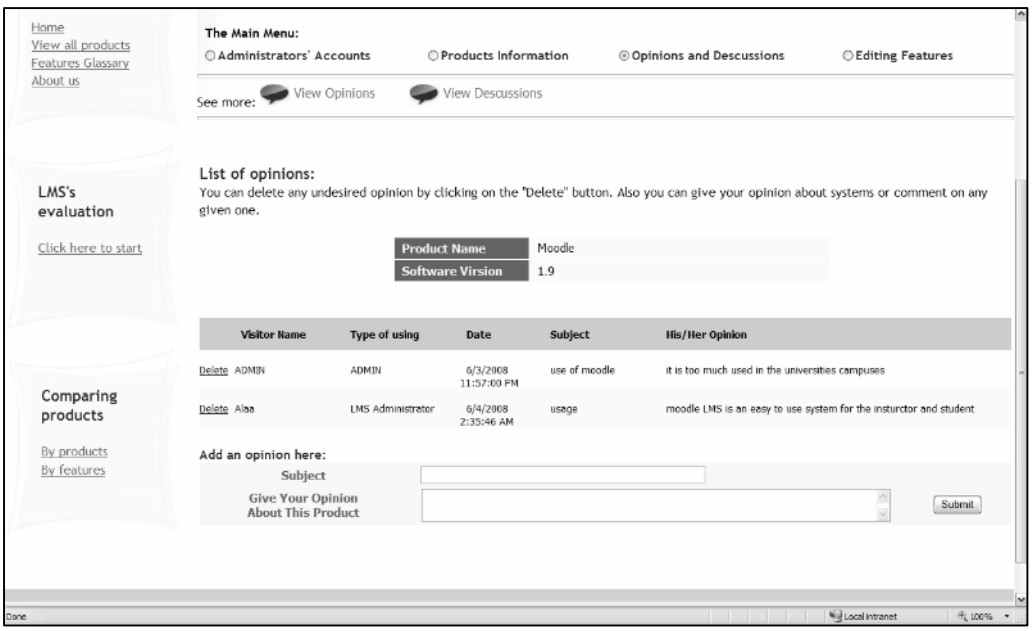

Figure A.18: The list of all opinions with giving opinions frame of the administrator

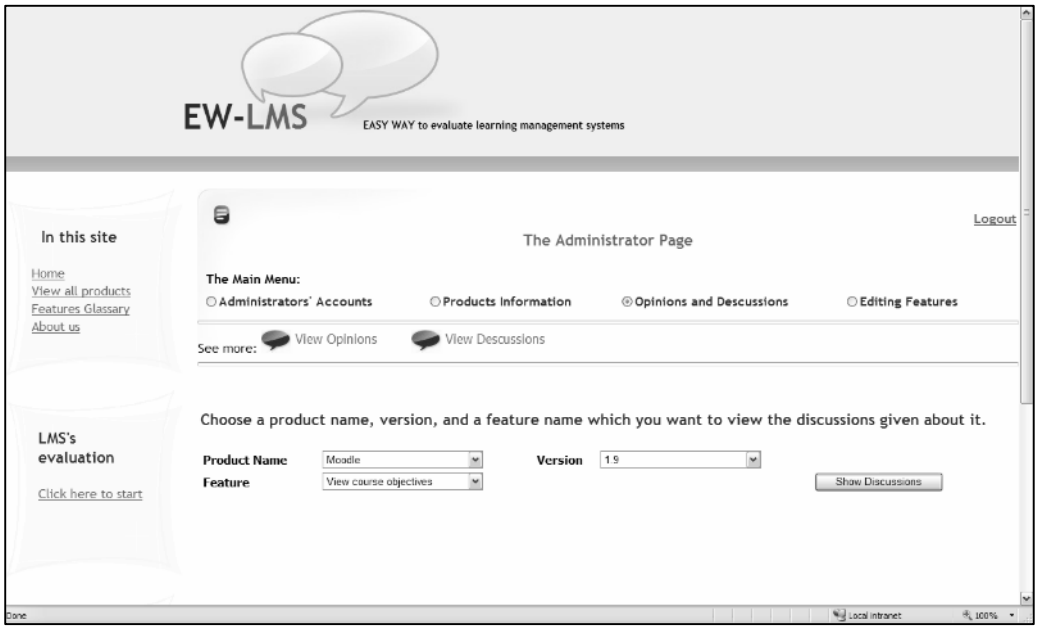

Figure A.19: Choosing a product, its software version, and the feature's name in order to show a list of all discussions given about the feature

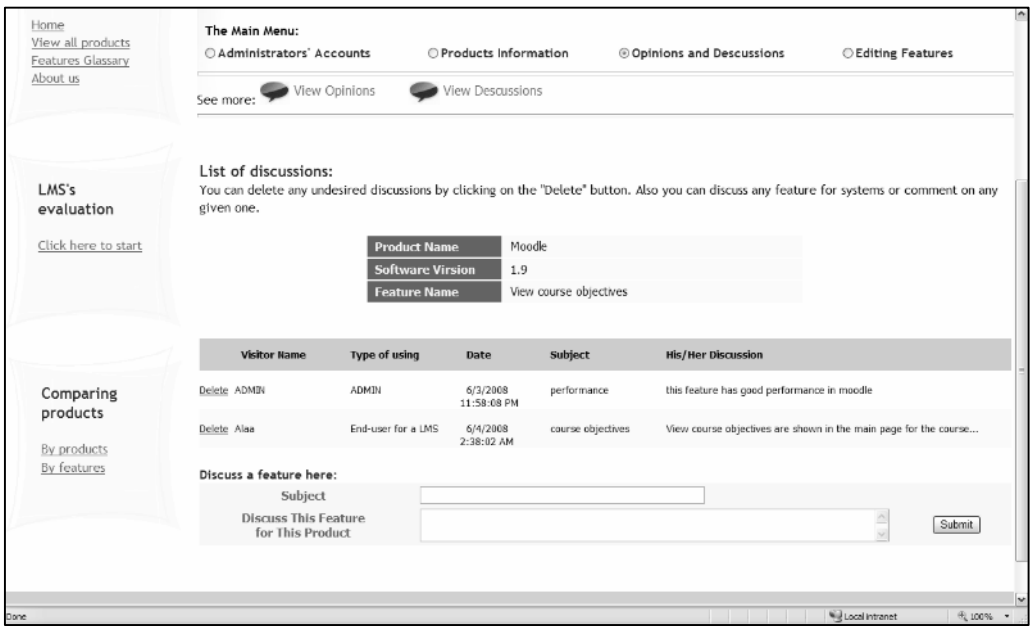

Figure A.20: The list of all discussions & the discussing frame of the administrator

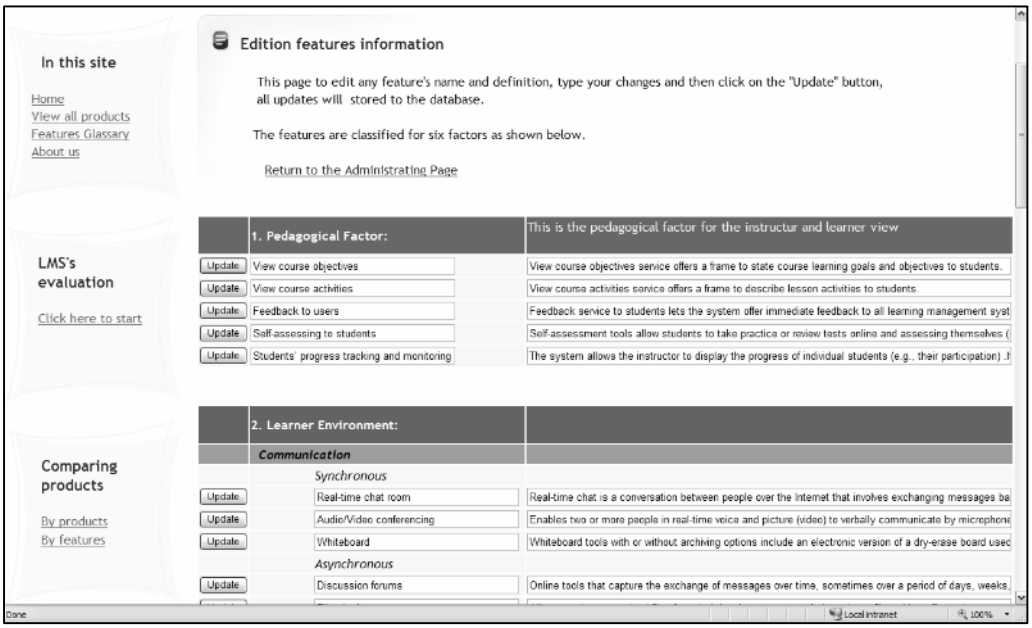

Figure A.21: Editing features form of the administrator

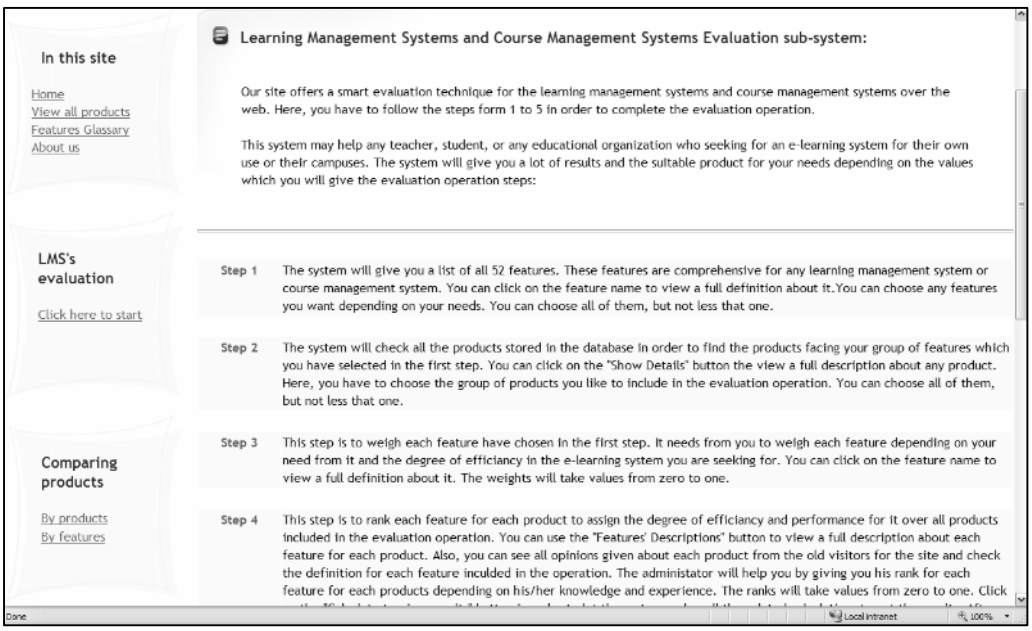

Figure A.22: Evaluation operation / starting page (1)

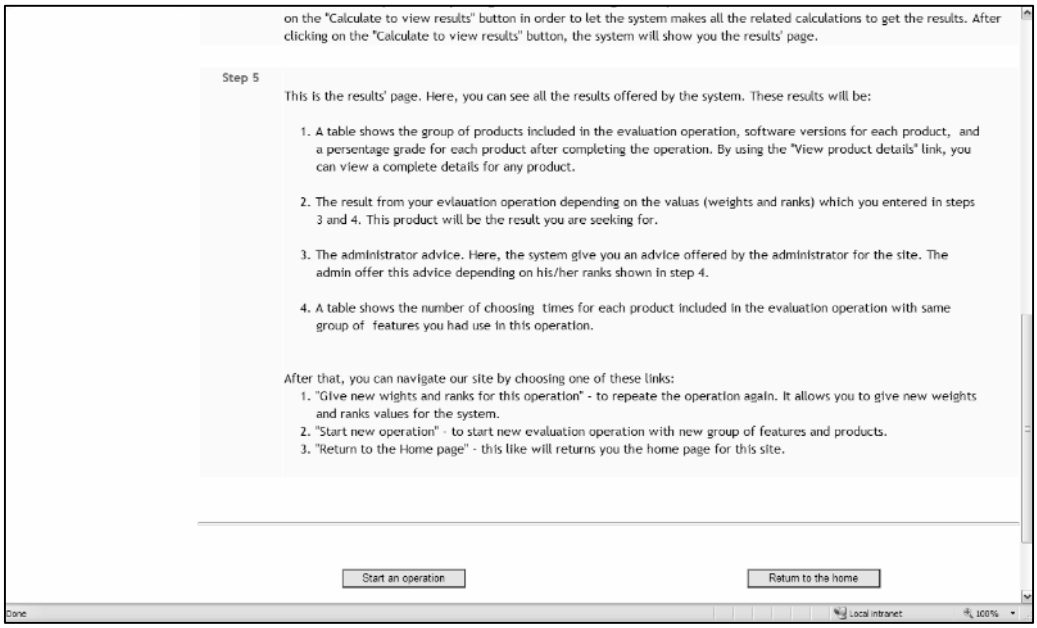

Figure A.23: Evaluation operation / starting page (2)

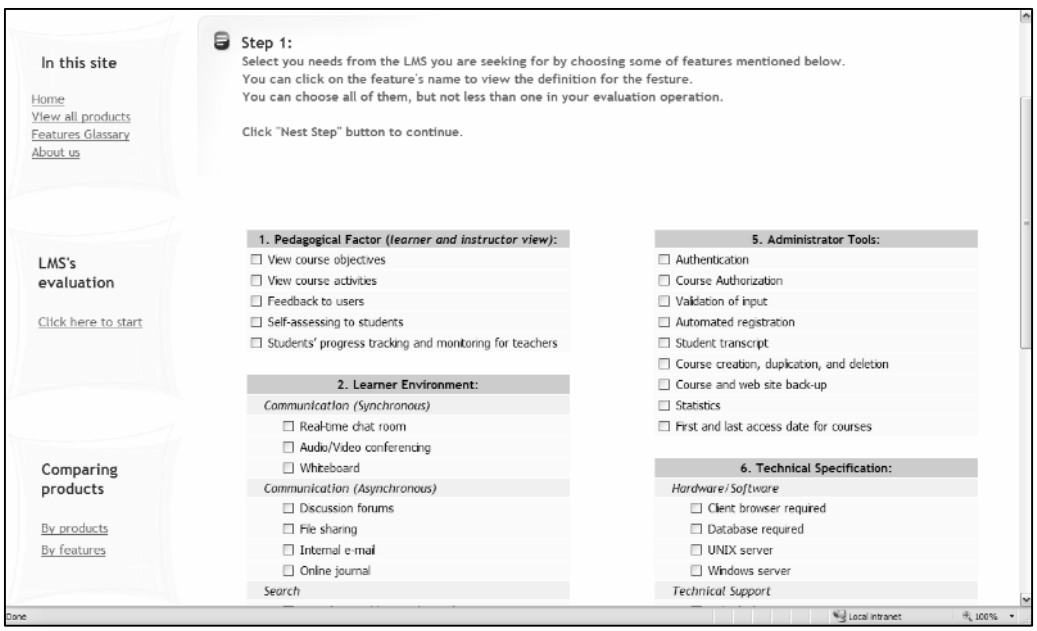

Figure A.24: Step 1 in the evaluation operation; selecting your needs

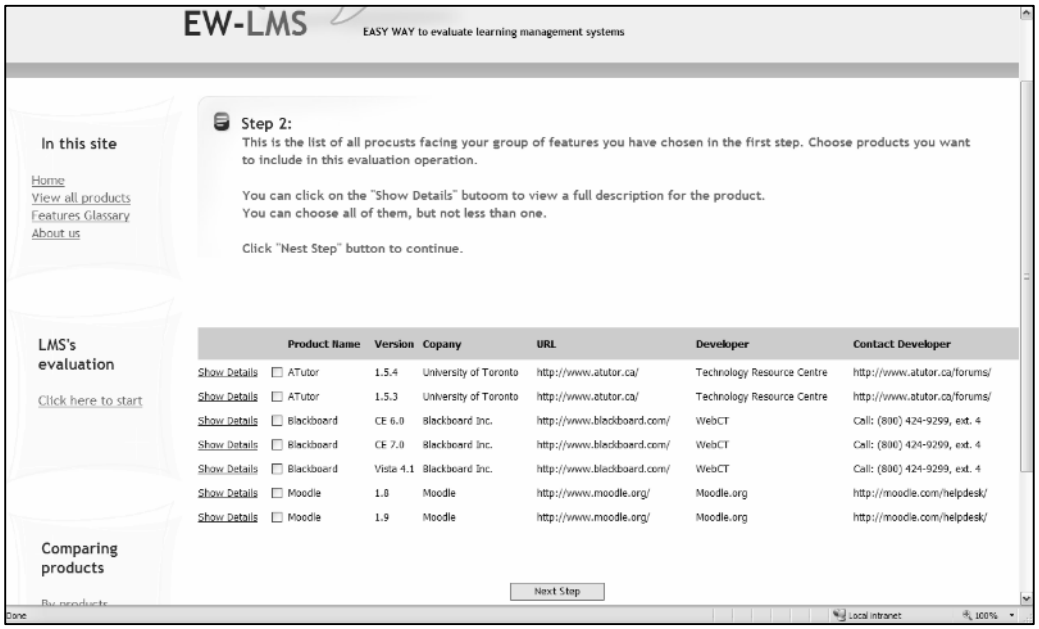

Figure A.25: Step 2 in the evaluation operation; choosing the group of products

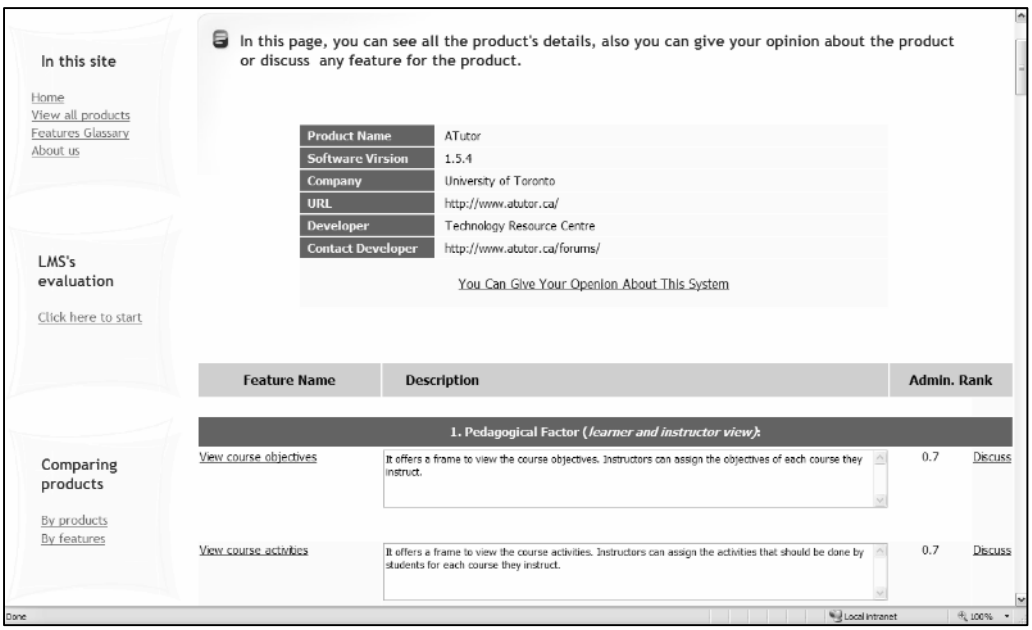

Figure A.26: Product's features description page

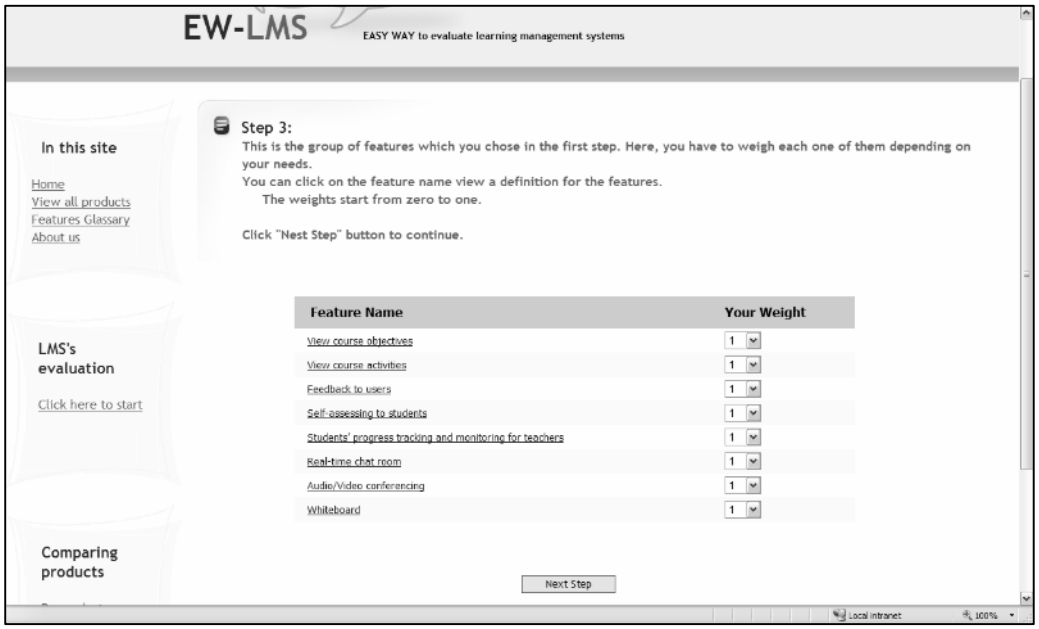

Figure A.27: Step 3 in the evaluation operation; weighing features

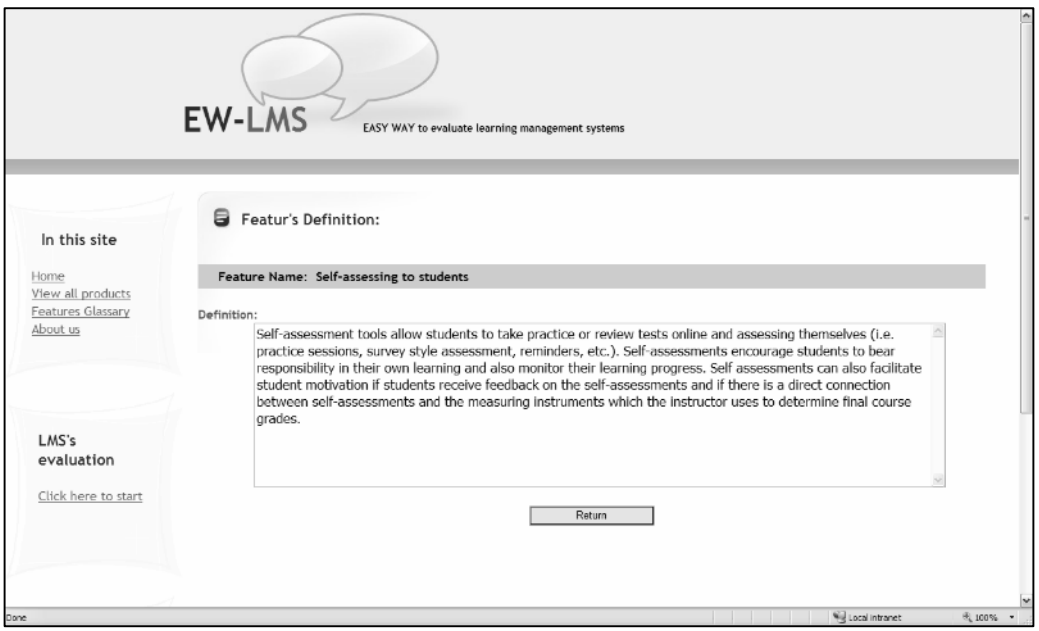

Figure A.28: Feature's definition page, inside the evaluation operation

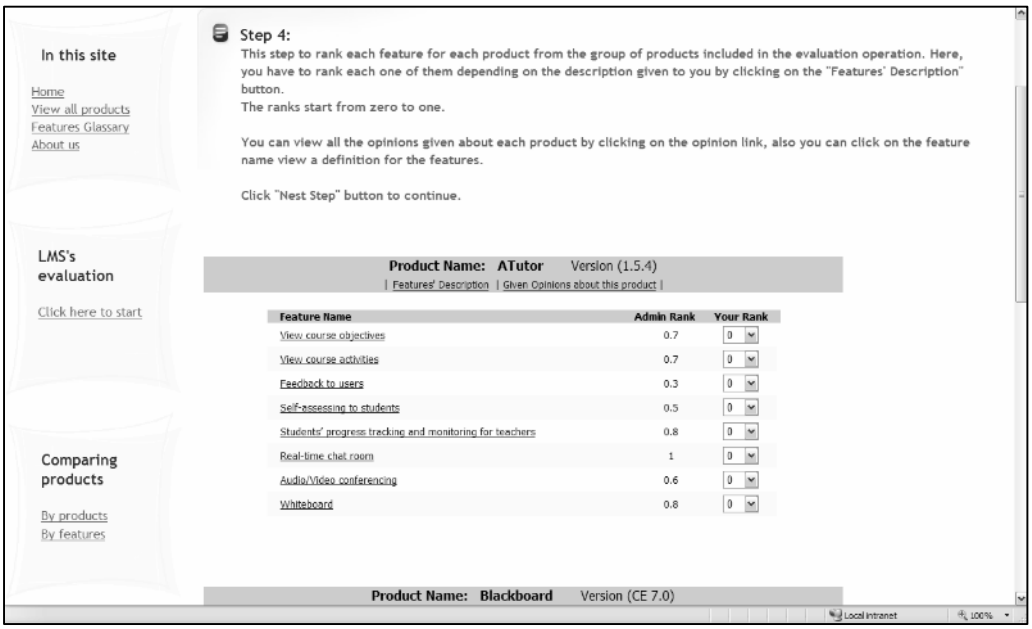

Figure A.29: Step 4 in the evaluation operation; ranking features of products

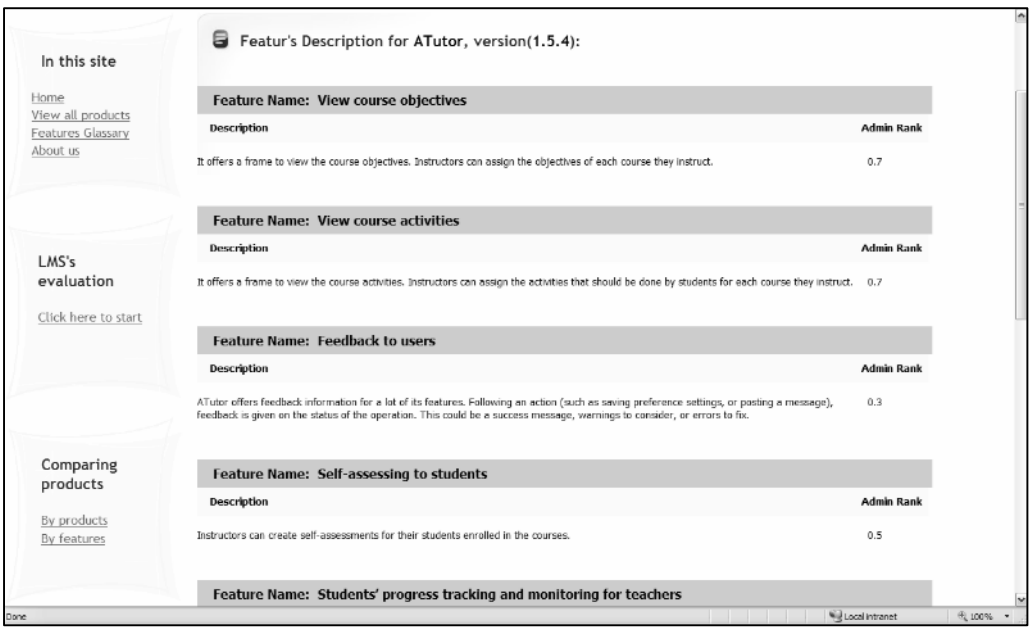

Figure A.30: products features' description page, inside the evaluation operation

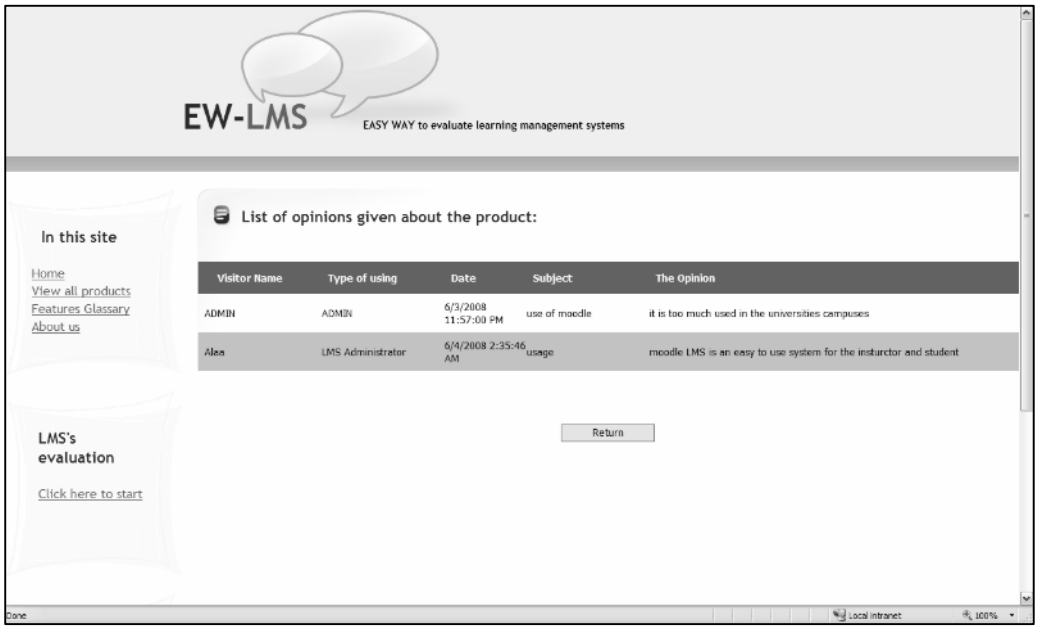

Figure A.31: Opinions given about a product, inside the evaluation operation

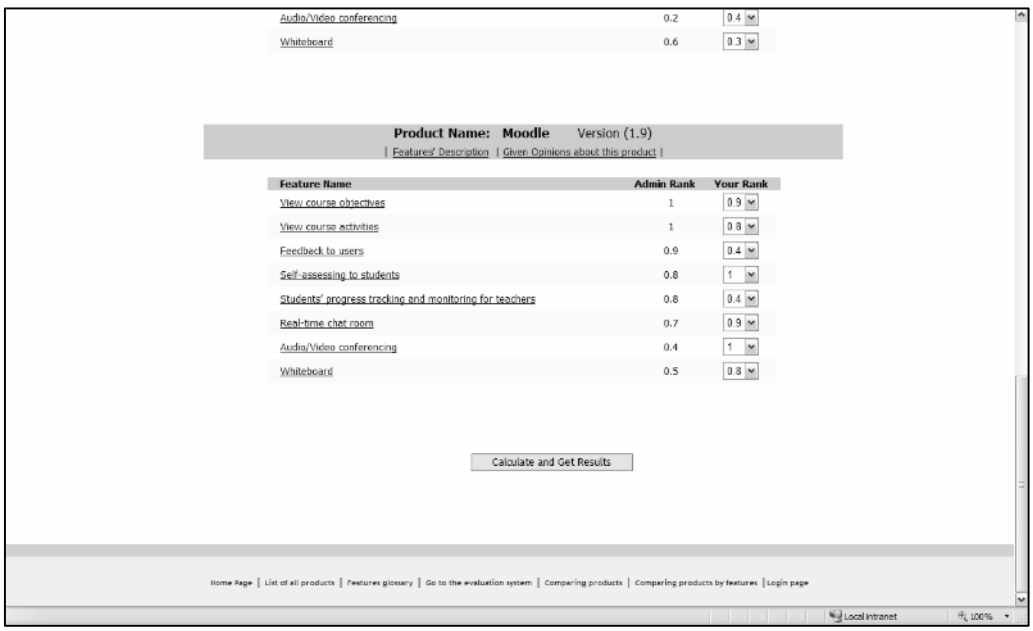

Figure A.32: The "Calculate and get Results" button in step 4

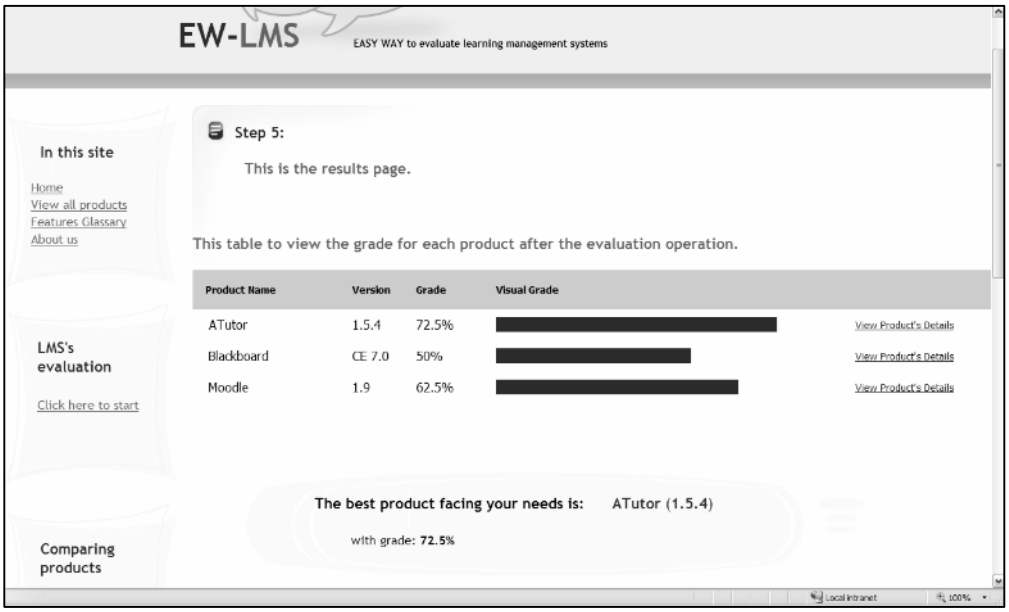

Figure A.33: The Results page (1)

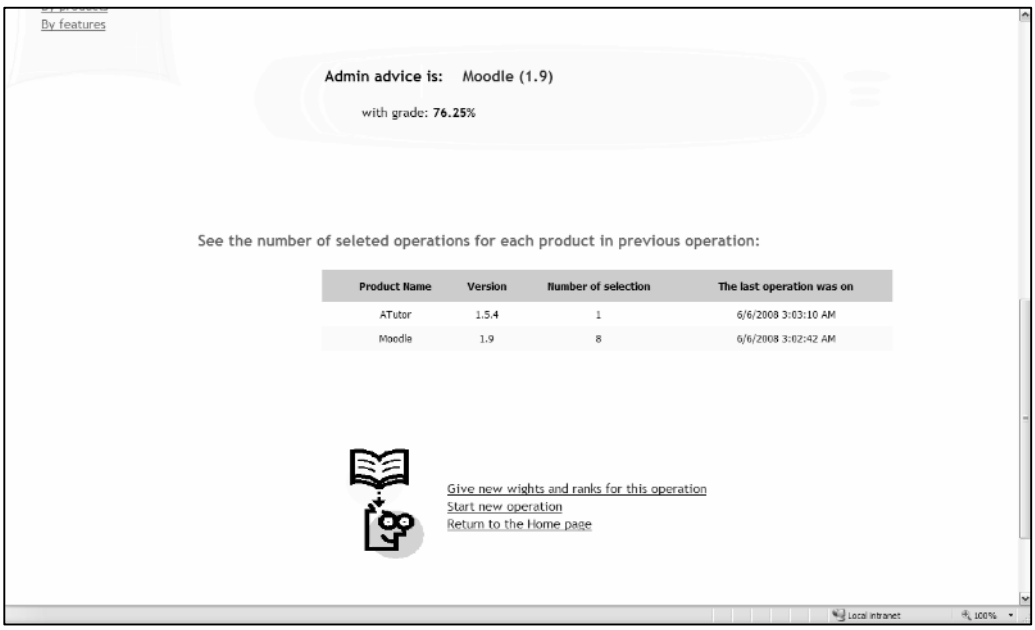

Figure A.34: The Results page (2)

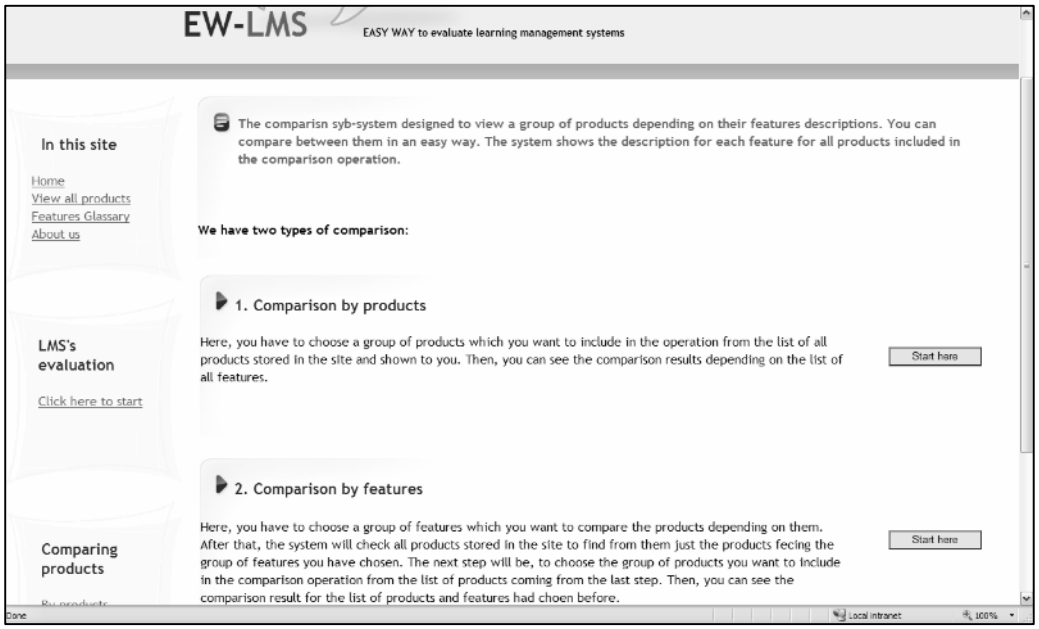

Figure A.35: Comparing products' page, the start page

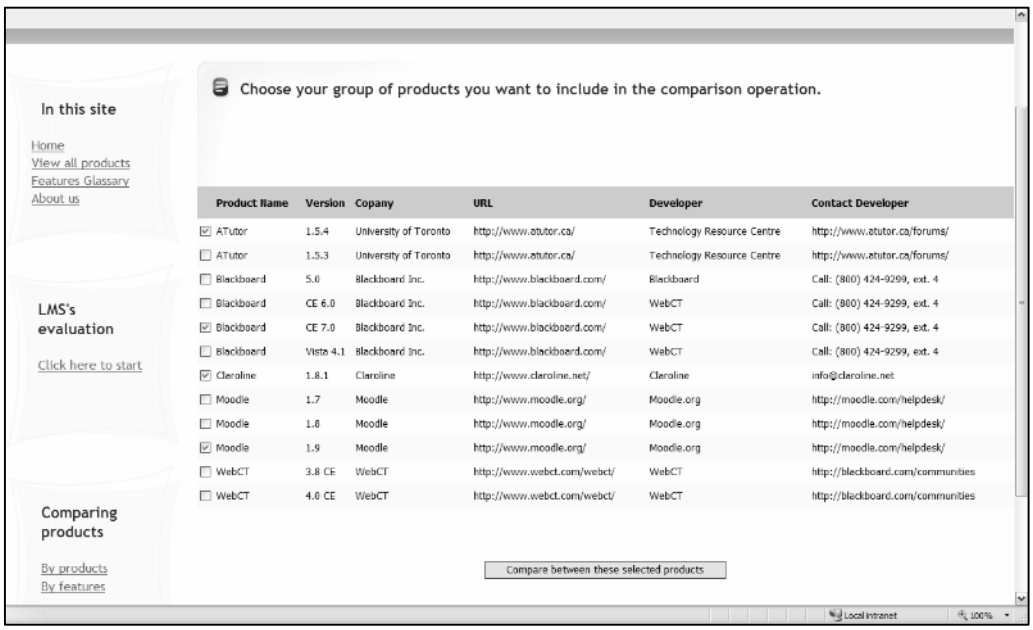

Figure A.36: The list of all products in comparing products sub -system

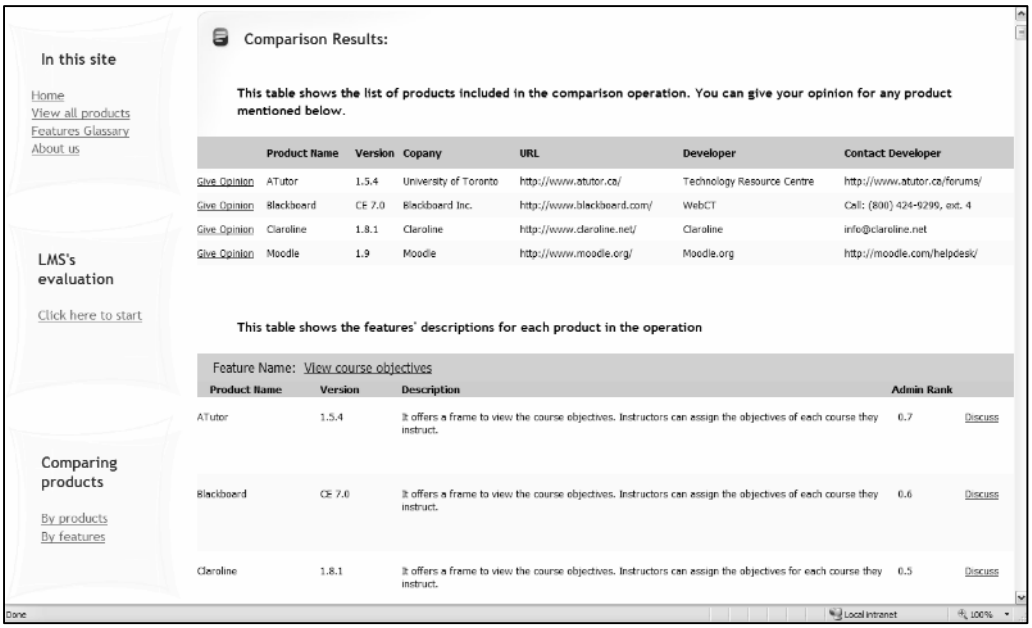

Figure A.37: Comparison results page

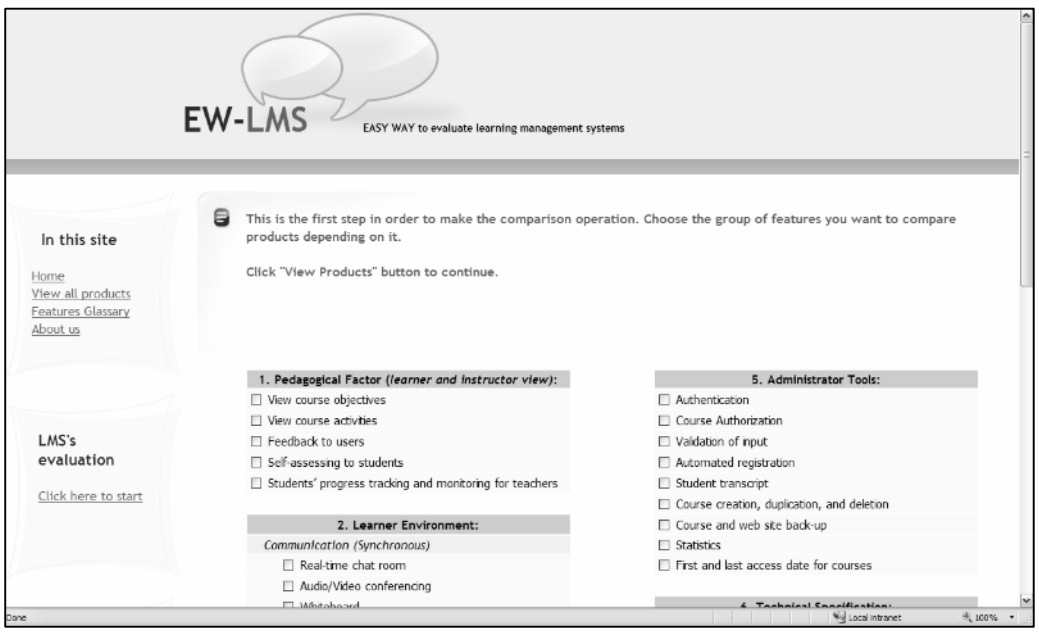

Figure A.38: Filtering products depending on their features

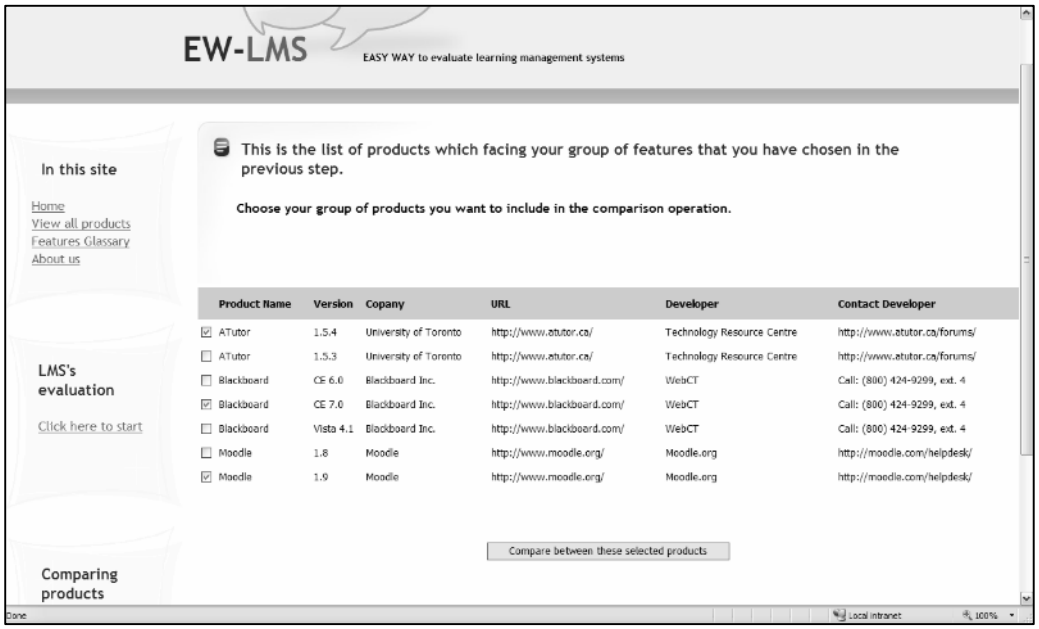

Figure A.39: List of products after filtering

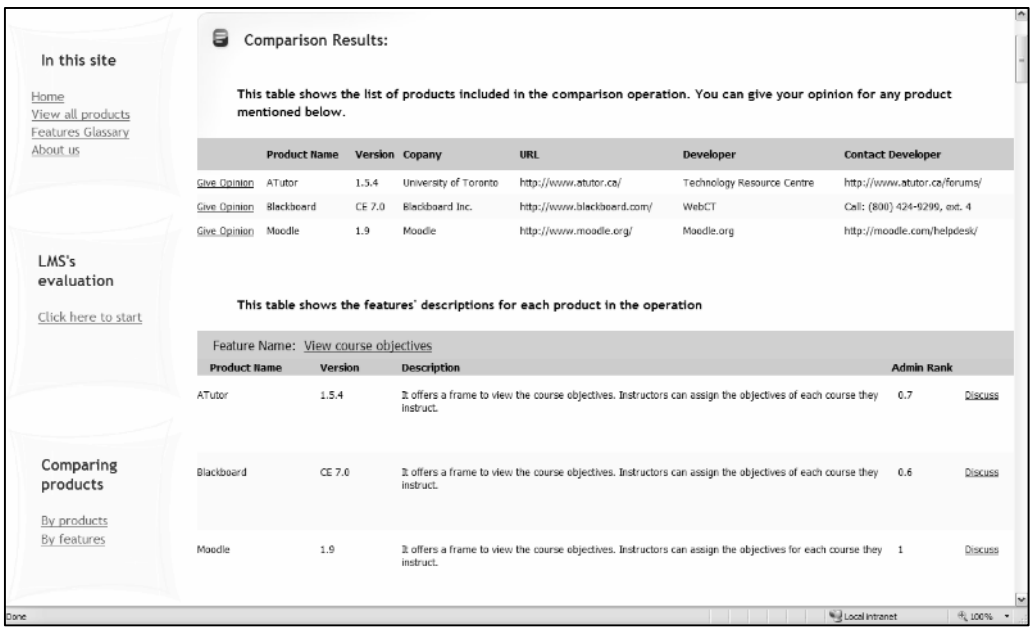

Figure A.40: Comparison results page for comparing by features service

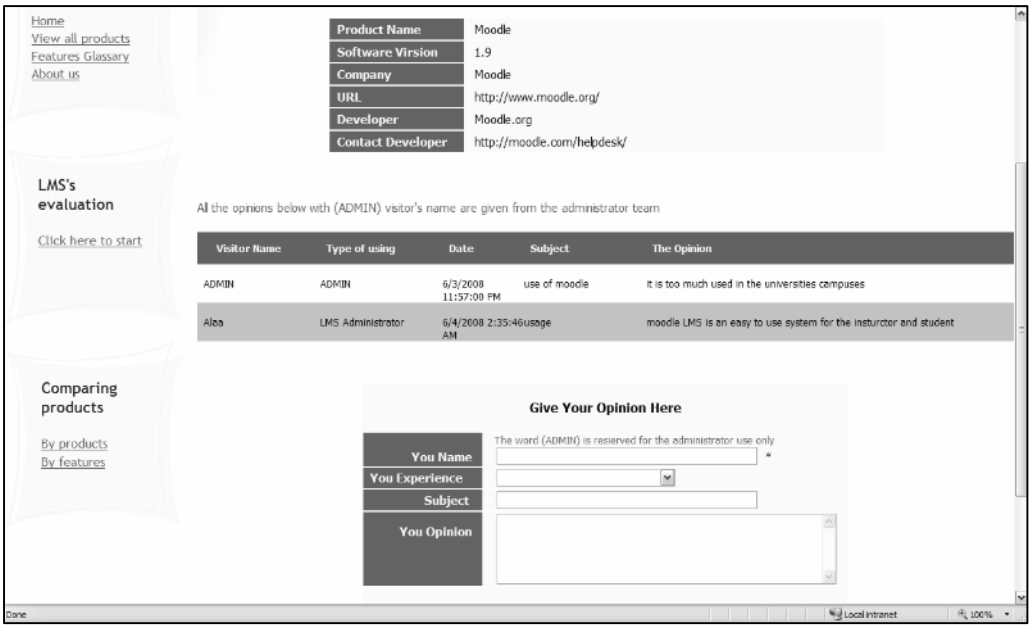

Figure A.41: Opinions about products' page

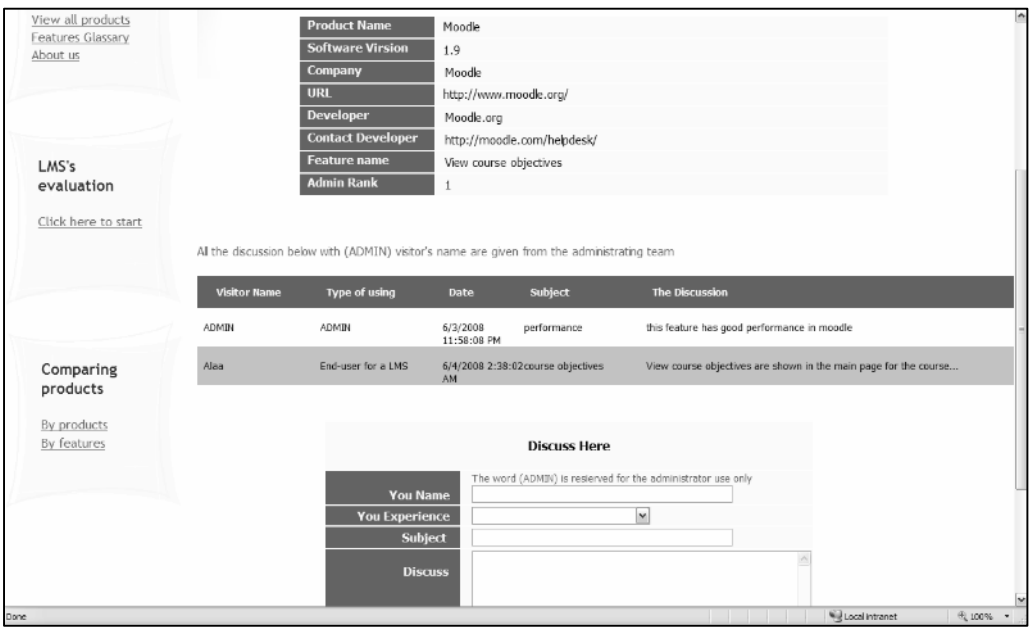

Figure A.42: Discussions features for products page

APPENDIX B

LEARNING MANAGEMENT SYSTEMS' FEATURES DESCRIPTION

Included in our Study and in our System's Database

Product Name: ATutor
Version: 1.5.3
Company: University of Toronto
URL: http://www.atutor.ca/
Developer: Adaptive Technology Resource Centre
Contact Developer: http://www.atutor.ca/forums/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives of each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	ATutor offers feedback information to a lot of its features. Following an action (such as saving preference settings, or posting a message), feedback is given on the status of the operation. This could be a success message, warnings to consider, or errors to fix.
Self-assessing for students:	Instructors can create self-assessments for their students enrolled in the courses.
Students' progress tracking and monitoring for teachers:	Instructors can get reports showing the time and date and frequency students as an aggregated group accessed course content. Also the instructors can review the navigation record of each student.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports a limited number of simultaneous rooms and supports unlimited simultaneous group discussions. Students can create new rooms. The chat tool supports a structured way to students to ask questions and instructors to provide answers. The system creates archive logs for all chat rooms. The Chat is accessible to assistive technology users.

	Message refresh rate can be controlled. Message refresh can be manually controlled. Message display can be controlled (top to bottom or bottom to top). User-plane module can also be used for additional audio/video based chat. Students from different courses can interact in system-wide chat rooms.
Audio/Video conferencing:	Audio/video communication included in the whiteboard tool.
Whiteboard:	The whiteboard supports image and PowerPoint uploading. The software supports graphing, polling, instructor moderation, group web browsing, and application desktop sharing. It can archive a recording of whiteboard sessions for future viewing. Also it supports two-way voice chat and video communication. The whiteboard is available using the Marratech module.
Asynchronous:	
Discussion forums:	Students can enable or disable posts to be sent to their email. They can subscribe to forums or specific forum threads to have message notifications sent to them by email. They can access current forum posts from anywhere within a course using a Forums side-menu block. Discussions can be shared across courses, departments, or any institutional unit. Instructors can lock forums from posting and/or reading and attach important forum content to the beginning of the thread list. They can edit and delete forum posts and can assign forum management privileges to students. Students from different courses can interact in system-wide discussion forums.
File sharing:	Students can submit assignments using drop boxes. They can share the contents of their personal folders with other students. Administrators can define disk space limitations for each user. Students have a private personal folder. Students and Instructors can create a dialog or comment on specific files. Also version tracking is available for files. Instructors can share contents with other instructors and students through a central learning objects repository. The repository can be a system-wide for individual organizational units. Tools are available to enable version tracking and linking to specific versions as well as the creation and management of workflows for collaborative content creation and review.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. They can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Students can elect to forward their mail to an external address. Instructors can email all members of groups at once.
Online journal:	It allows students to post questions, maintain a course diary, or aid revision.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to group of all courses in the site. Search keywords within the results are highlighted.
Search within courses:	Students can search across all courses they are enrolled in and not enrolled with a single search. Search result can display

	course summaries and the text surrounding the searched terms. Search terms within the results are highlighted.
Calendar/ Progress Review:	Instructors and students can post events in the online course calendar. They can post announcements to a course announcement page. Students have a personal home page that lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. A multilayer calendar is available using the Web-Calendar module. Administrators and instructors can have their events layer onto course or individual level calendars.
Student profile:	Students can add personal information about themselves for others to see, and include a profile picture, which is also displayed with forum posts.
Work offline:	Students can compile and download the contents of an entire course into a format that can be printed or stored locally. They can download course content and discussion group content. They can create content packages that can viewed offline locally, on another device, or in another system that support the content packaging specifications.

C. Instructor Tools (Course Development):	
Online editor for course organization:	ATutor has a built-in course editor to help instructors in building their courses. Instructors can assign students to groups. The system can randomly create groups of a certain size or a set number of groups. Each group can have its own discussion forum and can be given group-specific assignments or activities. Groups may be private or instructors can monitor groups. Instructors can manually assign students to groups. Tools can be configured on a group by group basis. Each group has its own file sharing area. Tests/quizzes can be assigned to groups.
Online quiz editor:	It is a built-in tool that helps instructors in building quizzes for their courses.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments. They can permit multiple attempts. The students are allowed to review past attempts of a quiz. Instructors can specify whether correct results are shown as feedback. The system supports proctored tests. It can choose a limited number of questions from a larger pool. System can make partial test results available for questions that can be auto-marked (True/False, Multiple Choices). Test results can be hidden until all students' tests have been received. Test results can be released as soon as a student has completed a test. Instructors can create personal test banks and the system provides test analysis data. Test Types that are available in ATutor: Multiple choice, Multiple answer, Fill-in the blank, Short answer, Survey questions, and Essay. Questions can contain other media elements (images, videos,

	audio).
Online grading:	Instructors can choose to mark each student on all questions or to mark each question on all students. Instructors can assign partial marks to partially correct answers. Instructors can change marks on auto-marked answers.
Course templates:	The system allows administrators to use an existing course or a pre-defined template as a basis for a new course. Instructors can reuse courses as templates for future lessons.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. Instructors can release materials based on a single criteria (date, grade, etc.) or they can use Boolean expressions to identify multiple selective release criteria. Instructors can link discussions to specific dates or course events. They can personalize access to specific course materials based on group membership. Instructors can create linear learning sequences organized hierarchically by course, lesson, and topic.
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the order and name of menu items for a course. They can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look and feel templates as well as institutional images, headers and footers. Instructors can change and reorder navigation icons, navigation tabs, and side-menu blocks.
Automated glossary:	The Glossary lists all course terms, their definitions and related terms. Terms can be added to the glossary by using the Add Glossary Term link in the Glossary Manager or by adding terms directly into content while it is being created using the Content Editor. The Glossary is a Student Tool and can therefore be enabled or disabled, linked from the main menu, linked from the home page, or displayed as a module in the side menu.

E. Administrator Tools:	
Authentication:	Any courses created can be public (no login information required), protected (public but login is required), or private (login and approved enrolment required to) in order to access the course contents.
Course Authorization:	Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. Instructors or students may assign different roles in different courses. They can assign individual tool use privileges to students to create assistants for any number of course management tasks. Administrators can assign individual administrative tool privileges to create secondary system administrators to manage specific system tasks. Also administrators can create a master student list upon which new

	registrations can be limited.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Both instructors and administrators can add students to the system using a delimited text file. Besides, instructors can export a list of enrolled students.
Course creation, duplication, and deletion:	Instructors can create, edit, and duplicate, any of their courses. The administrator can also do the same.
Course and web site back-up:	RAID disk backup is available. Also the system is allowed to make nightly system backups automatically. The entire content and structure of a course can be backed up and stored on the ATutor server, or downloaded and saved to your local computer, create a copy of a course as a master for future sessions, or move a course to a new location.
Statistics:	Individual usage statistics can be reviewed to identify gaps in content coverage and the learning tendencies of each learner. Instructors can view course login statistics, edit course properties, and send course-wide email messages. A default display language can be set for each course. Assign a course as public, protected, or private, or hide a course while it is being developed. Control student access to content packaging.

F. Technical Specification:	
Hardware/Software	
Client browser required:	All browsers are supported. The system complies XHTML 1.0 specification.
Database required:	The system supports MySQL. The application requires only one database and can coexist with tables from other applications.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.
Technical Support	
Help desk:	Students can access context sensitive help to any tool. Help materials are searchable and student and instructors can contribute to help materials. Help materials.
Multi-languages support:	Fully internationalized (30+ languages). The system allows custom language editor.
Pricing/Licensing	
Company profile:	Adaptive Technology Resource Centre – University of Toronto.
Open source:	The software is distributed under one of the OSI-approved licenses.

Product Name:	ATutor
Version:	1.5.4
Company:	University of Toronto
URL:	http://www.atutor.ca/
Developer:	Adaptive Technology Resource Centre
Contact Developer:	http://www.atutor.ca/forums/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives of each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	ATutor offers feedback information for a lot of its features. Following an action (such as saving preference settings, or posting a message), feedback is given on the status of the operation. This could be a success message, warnings to consider, or errors to fix.
Self-assessing for students:	Instructors can create self-assessments for their students enrolled in the courses.
Students' progress tracking and monitoring for teachers:	Instructors can get reports showing the time and date and frequency students as an aggregated group accessed course content. They can review the navigation record of each student. Students can access their own tracking information.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports a limited number of simultaneous rooms. The system creates archive logs for all chat rooms. Chat is accessible to assistive technology users. Users can control message refresh rate. Messages can be automatically or manually refreshed. Messages can be displayed top to bottom, or bottom to top. User plane module provides audio/video chat. Students from different courses can interact in system-wide chat rooms. Using the User-plane chat module, or the illuminate module, students can interact using voice and/or video, within a course, across courses, or through a central user community. Also students see a list of other students currently online, and communicate with them. Central community forums include: support, bug reports, feature requests, translators, and general discussions.
Audio/Video conferencing:	Audio/video communication included in the whiteboard tool.

Whiteboard:	The whiteboard supports image and PowerPoint uploading. The software supports group web browsing. It supports application desktop sharing. It can archive a recording of whiteboard sessions for future viewing and supports two-way voice chat. Whiteboard is available using the Marratech module. Accessibility compliant whiteboard available (Acomm) includes peer descriptions for students with disabilities.
Asynchronous:	
Discussion forums:	Students can enable or disable posts to be sent to their email. They can subscribe to forums or specific forum threads to have message notifications sent to them by email and can access current forum posts from anywhere within a course using a Forum's side menu block. Each Student can edit his/her forum posts for a specified period of time. Forum access can be limited to group members or used by a whole class. Instructors can allow students to create discussion groups. Posts may be peer reviewed by other students. Discussions can be shared across courses, departments, or any institutional unit. In structors can lock forums from posting and/or reading. They can attach important forum content to the beginning of the thread list and can edit, move, and delete forum posts. Instructors can assign forum management privileges to students. Students from different courses can interact in system-wide discussion forums.
File sharing:	Students can submit assignments using drop boxes. The administrators can define disk space limitations for each course. Instructors and students can comment on files. Text based files can be edited online. Administrators can enable file versioning on a course by course basis. Instructors can share content with other instructors and students through a central learning objects repository. The repository can be a system-wide for individual organizational units. The repository supports IEEE LOM and metadata application profiles such as, Dublin Core, Cancore, and custom profiles. Repository functionality is available using the TLE, TILE, and MERLOT modules. System imports and exports IMS and SCORM conformant content packages.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. Students can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Students can elect to forward their mail to an external address. Instructors can limit mailing to students, assistants, alumni, groups, all enrolled, or all waiting for enrolment. All users can export an archive of sent and received email messages.
Online journal:	It allows students to post questions, maintain a course diary, or aid revision.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to group of all courses in the site. Search keywords within the results are highlighted.

Search within courses:	Students can search all course content. Students can search across all courses they are enrolled in with a single search. They can search courses they are not enrolled in. Search result can display course summaries and can display the text surrounding the searched terms. Search terms within the results are highlighted.
Calendar/ Progress Review:	Students can search within the terms and keywords related to group of all courses in the site. Search keywords within the results are highlighted.
Student profile:	Students can add personal information about themselves for other to see, and include a profile picture, which is also displayed with forum posts.
Work offline:	Students can compile and download the content for an entire course into a format that can be printed or stored locally. Students can download course content and discussion group content with a PDA. If enabled, students can download content packages for course units, or an entire course, that can be viewed offline.

C. Instructor Tools (Course Development):	
Online editor for course organization:	ATutor has a built-in course editor to help instructors in building their courses. Instructors can assign students to groups. The system can randomly create groups of a certain size or a set number of groups. Each group can have its own discussion forum and can be given group-specific assignments or activities. Groups may be private or instructors can monitor groups. Groups can be configured with their own forums, file sharing, blogs, and link database. Tests/quizzes can be assigned to groups.
Online quiz editor:	It is a built-in tool that helps instructors in building quizzes for their courses.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments. Instructors can permit multiple attempts. The students are allowed to review past attempts of a quiz. Instructors can specify whether correct results are shown as feedback. The system supports proctored tests. System can choose a limited number of questions from a larger pool. It can make partial test results available for questions that can be auto-marked (True/False, Multiple Choice, Multiple Answer). Test results can be hidden until all students' tests have been received. Its results can be released as soon as a student has completed a test. Custom liker scales can be created for survey questions. Instructors can create personal test banks. The system provides test analysis data. Instructors can export test question in QTI 2.1 format. Test types available in ATutor: Multiple choice, Multiple answer, Matching, Ordering, Fill-in the blank, Short answer, Survey questions, and

	Essay. Questions can contain other media elements (images, videos, audio).
Online grading:	Instructors can choose to evaluate student responses anonymously. Closed question types can be marked automatically and results made available immediately. Test results can be immediately released to students, or delayed and released all at once. Students can review their marks and review test/question submissions. Instructors can export marks in CSV format and assign partial marks to partially correct answers. They can change marks on auto-marked answers. They can export the scores in the grade-book to an external spreadsheet. Test grades are integrated with the Test & Survey Manager.
Course templates:	The software provides support for template-based course creation. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course. Instructors can reuse courses as templates for future lessons.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. They can release materials based on a single criteria (date, grade, etc.) or use Boolean expressions to identify multiple selective release criteria. Instructors can personalize access to specific course materials based on group membership, organize learning objects, course tools, and content into learning sequences that are reusable. Instructors can create linear learning sequences organized hierarchically by course, lesson, and topic.
Customize look and feel:	The system provides default course look and feel templates. Institutions can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look and feel templates as well as institutional images, headers and footers. Instructors can change and reorder navigation icons. They can change and reorder navigation tabs and change and reorder side-menu blocks.
Automated glossary:	The Glossary lists all course terms, their definitions and related terms. Terms can be added to the glossary by using the Add Glossary Term link in the Glossary Manager or by adding terms directly into content while it is being created using the Content Editor. The Glossary is a Student Tool and can therefore be enabled or disabled, linked from the main menu, linked from the home page, or displayed as a module in the side menu.

E. Administrator Tools:	
Authentication:	The system can authenticate against an external LDAP server. Instructors can give guests access to their courses. A master list can be created to limit registration on the system to authorized users only.
Course Authorization:	Instructors can give guests access to their courses. A master list can be created to limit registration on the system to authorized

	users only. Administrators can assign individual administrative tool privileges to create secondary system adminis trators to manage specific system tasks. Instructors can assign individual tool use privileges to students to create assistants for any number of course management tasks. Multiple instructors can be creating for each course, with privileges to use any numb er of the available tools. Courses can be public (no login required), protected (public but login is required) or private (login and approved enrolment required).
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can add students to the system using a delimited text file. The software supports data interchange with student information systems through an event - driven API.
Course creation, duplication, and deletion:	Instructors can create, edit, duplicate, any one of their course. Also the administrator can do the same.
Course and web site back-up:	RAID disk backup is available. Also the system is allowed to make nightly system backups automatically. The entire content and structure of a course can be backed up and stored on the ATutor server, or downloaded and saved to your local computer. Create a copy of a course as a master for future sessions, or move a course to a new location. Generate backups of courses to create master copies. Download backups for safe keeping or to move courses to another ATutor server. Use backups to generate new courses.
Statistics:	Individual usage statistics can be reviewed to identify gaps in content coverage and the learning tendencies of each learner. Instructors can view course login statistics, edit course properties, and send course-wide email messages. A default display language can be set for each course. Assign a course as public, protected, or private, or hide a course while it is being developed. Control student access to content packaging.
First and last access date for courses:	Instructors can get reports showing the time and date and frequency students as an aggregated group access ed course content.

F. Technical Specification:	
Hardware/Software	
Client browser required:	System functions with any browser and functions on mobile technologies. System complies with XHTML 1.0 specification.
Database required:	The system supports MySQL. The application requires only one database and can coexist with tables from other applications.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.

Technical Support	
Help desk:	Pages of the help system are linked to their respective tools for easy access. Tutorials, and other documentation, are available through the product provider's website for students, instructors and administrators. Help materials are searchable and Student and instructors can contribute to help materials.
Multi-languages support:	Fully internationalized (30+ languages). Custom language editor.
Pricing/Licensing	
Company profile:	Adaptive Technology Resource Centre – University of Toronto. Primary focus accessibility of information technology.
Open source:	The software is distributed under one of the OSI-approved licenses.

Product Name:	Blackboard
Version:	Vista 4.1 Enterprise License
Company:	Blackboard Inc.
URL:	http://www.blackboard.com/
Developer:	WebCT
Contact Developer:	For sales inquiries, call: (800) 424-9299, ext. 4

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surveys to collect feedback from Students. Blackboard offers useful feedback for instructors.
Self-assessing for students:	Instructors can create self-assessments for their students enrolled in the courses. They can provide personalized comments for essay/short answer questions, and can add comments to assessment results.
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. They can get reports showing the time and date and frequency students as an aggregated group accessed course content. Also can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. They can review the navigation record of each student. Instructors can export all students' tracking data and share tracking information with students. In Vista, tracking data can also be aggregated across departments or schools. Administrators can extract tracking data for students and faculty to optionally merge with other data sources and create reports using a third party reporting tool.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. Instructors may moderate chats and suspend students from the chat rooms. The chat tool supports a structured way for students to ask questions and instructors to provide answers. The system creates archive logs for all chat rooms. It does not limit the number of simultaneous rooms. Students can see who else is online across the entire system and invite them to a chat room. That is combined with whiteboard

	tool, see whiteboard description for more information.
Audio/Video conferencing:	Audio/Video conferencing is available with the chat service.
Whiteboard:	The whiteboard supports image and PowerPoint uploading. It also supports mathematical symbols. The software can archive a recording of whiteboard sessions for future viewing. Whiteboard usage can be moderated, and is combined with the chat tool (see chat description for more information).
Communication *(Asynchronous):*	
Discussion forums:	A spell-checker is available for student and instructor responses. Discussion forums can be threaded, blog format or journals (individual or group). Discussion forums can be viewed by topic, by date, and by thread. Discussion threads are expandable and collapsible to view an entire conversation in one screen. Instructors can associate a discussion with any course content. Posts can contain URLs, file attachments and may contain HTML. The threaded discussion software includes a formatting text editor which can create mathematic equations. Discussion forums allow texts to be selected and compiled for downloading and printing. Discussion posts can be peer reviewed on a flat scale or using a two dimensional rubric-like grading forms. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. Discussion topics can be made gradable and a grading interface provided. Grading can be assigned by grading form (rubric), numeric or alphanumeric grade. Instructors can limit discussions to specific time periods. Instructors can enable or disable anonymous posting, and determine whether student posts are re-editable. Discussions can be saved or printed for off-line reading. Instructors can restrict creation of new discussion threads or all new posts within any discussion topic. When instructors create group discussions or journals, they only create a topic once and then topics for every group or student are created with appropriate read and posting permissions.
File sharing:	Students can submit assignments using drop boxes. Administrators can define disk space limitations for each user. Students have a private folder into which they can upload and download files. They may access their folders using WebDAV. Instructors can share content with other instructors and students through a central learning objects repository. The repository can be system-wide or for individual organizational units. For any content in the repository, users can view reports displaying every course in the system that is currently using the selected item.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. They can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Students can elect to forward their mail to an external

	address. The internal email system supports archiving, searching and attachments. Students can spell check outgoing messages.
Online journal:	Students can attach notes to any page. They can combine their notes with the course content to create a printable study guide. Journal discussion type provides a way for students to share notes and thoughts with the instructor and or other students. In journals that are not private other students m ay leave comments or rate journal posts using a flat scale or grading form (rubric).
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site enrolled in, also can search within the glossary words.
Search within courses:	Students can search all course content. In addition, they can search all discussion threads, search all assignments, course content, discussion threads, and email messages in their course and they can constrain a search using filters. Search of content includes the content of many common file formats such as HTML, Word, Excel, PowerPoint, and PDF.
Calendar/ Progress Review:	Instructors and students can post events in the online course calendar. They can post announcemen ts to a course announcement page. Students have a personal home page that lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. They can view their grades on completed assignments, total points possible, course grade, and compare their grades against the class performance. Calendar entries can be linked to course materials and activities. Events can be repeating. Institutional calendar events and announcements can be added as well. When Instructors copy a course from a previous term they can update all of the dates in their course calendar in one step.
Student profile:	Students can create a personal home page in each course. They use their personal home page to selectively display t heir course work. They can export their personal home page. They are given a private folder for content by default. A personal profile tool is included in the product and empowers students to choose what information to share with classmates. The Blackboard Portfolio for CE and Vista is available at additional cost and provides additional features for creating of a personal portfolio. See Blackboard website.
Work offline:	Students can compile and download the content for an entire course into a format that can be printed or stored locally. Instructors can publish course content on a CD-ROM that can be linked to dynamically from within the online course or viewed offline. They may also publish pod-casts or video lectures for download and offline playback.

C. Instructor Tools (Course Development):	
Online editor for course	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. They can

organization:	create linear learning sequences organized hierarchic ally by course, lesson, and topic. Also can reuse courses as templates for future lessons. All items can be conditionally released to provide appropriate progression or remediation as needed, based on time, grade book criteria, group membership and user ID.
Online quiz editor:	Instructors can create questions sets and categorize questions by difficulty and skill. They can import and export question sets, quizzes, surveys, and self-assessments for sharing with other courses.
Grade distribution:	Blackboard allows a grade distribution tool for each group of students in specific course. Instructors can benefit from the useful statistics about the grades and.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and ans wers. Instructors can create self-assessments. They can set a time limit on a test. They can permit multiple attempts. The students are allowed to review past attempts of a quiz. The system supports a MathML editor for the inclusion of mathematical formulas in questions. Test access can be restricted by IP range. Instructors can randomize answer order for multiple choice questions. Test types available in Blackboard are: Multiple choice, Multiple answer, Matching, Jumbled sentence, Calculated, Fill-in the blank, Short answer, Survey questions, and Essay. Questions can contain other media elements (images, videos, audio). Instructors can create personal test banks. Questions can be imported from external test banks that support QTI. The system provides test a nalysis data. Analysis reports are created items and for tests allowing instructors to determine where students have the most difficulty. If an instructor needs to fix a question, they can change the answer to a question and then automatically re-grade the entire class or selective students as necessary on the new question.
Online grading:	Instructors can choose to mark each student on all questions or to mark each question on all students. They can choose to evaluate student responses anonymously. Also ca n enable students to rate and comment on submissions of other students. When an instructor adds an assignment to the course, the software automatically adds it to the grade-book. Instructors can add grades for offline assignments. They add details to the grade-book in custom columns. Instructors also can export the scores in the grade-book to an external spreadsheet. They create a course grading scale that can employ either percents, letter grades, or pass/fail metrics. Gradable assignments, discussions and assessments are automatically added to the grade-book when added to a course. Name columns are frozen on left when scrolling grade book. Instructors can import grade-book columns and data from spreadsheet. They can create grading form (rubric) columns in the grade book and evaluate

	cumulative performance within that grading form. This allows instructors to see more just students did well or poorly on an assignment.
Course templates:	The software provides support for template-based course creation. Course content may be uploaded through WebDAV. Course templates may contain selective release criteria and custom grade-book columns that persist with each new course instance. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course. Vista course templates are parallel to the course delivery environment and allows instructors and instructional designers to work in an environment unavailable to students. Templates may contain look and feel settings, course frameworks, or entire course curricula. Institutions can create one or more base templates which can be used as a starting point for creation of templates for specific courses with a particular pedagogical style and/or look and feel, thus providing choice, while increasing standardization. Course templates may be copied (as new) to provide a starting point for another template or version of the same template. Instructors can work on a template for the next term while delivering courses based on this term. Instructors or administrators may copy sections to a template, thus ensuring instructors that the work they have done in one term may be carried forward as a template for sections in subsequent terms quickly and easily without affecting the original in any way. Administrators and instructors can organize learning objects into reusable learning sequences.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. They can release materials based on a single criteria (date, grade, etc.) or instructors can use Boolean expressions to identify multiple selective release criteria. Instructors can set up specific course content that is released on a specific date and must be completed by students before they continue with the course. They can link discussions to specific dates or course events, and they can personalize access to specific course materials based on group membership and personalize access to specific course materials based on previous course activity. They can personalize access to specific course materials based on student performance. Program and institutional goals may be specified using the "Goals" tool and tied to particular activities in the course.
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course and change the order and name of menu items for a course. They can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look

	and feel templates as well as institutional images, headers and footers.

E. Administrator Tools:	
Authentication:	The system can authenticate against an external LDAP server, can authenticate using the Kerberos protocol, supports Shibboleth, and supports the Central Authentication Service (CAS). Administrators can set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server) fails. The system can support multiple organizational units and virtual hosts within a server configuration. Blackboard supports both inbound and outbound authentications allowing rich interactions with external applications.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. They can distribute the permissions and roles across multiple institutions or departments hosted in the server environment. Instructors or students may be assigned different roles in different courses.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can transfer student information bidirectional between the system and an SIS using IMS Enterprise Specification v1.1 XML files via web services. The software is compliant with the IMS Enterprise Specification for Student Data. Vista supports real-time integration with multiple Student Information Systems allowing multiple institutions to run from one Vista installation.
Course creation, duplication, and deletion:	Instructors can create, edit, duplicate, any one of their course. The administrator can also do the same.
Statistics:	Usage statistics can be aggregated across courses or across the institution.
First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	For the Windows 2000 operating system, the following browsers are compatible: IE 6.0, Netscape 7.1 and 8.0, and Firefox 1.0. For Windows XP, the following browsers are compatible: IE 6.0 and 7.0, Netscape 7.1 and 8.0, and Firefox 1.0. For Mac OS 10.2, 10.3, and 10.4, compatible browsers

	include: IE 5.2, Netscape 7.1, Firefox 1.0, Safari 1.1, 1.2 and 1.3. A full browser matrix is available.
Database required:	The system supports Oracle and MS SQL Server.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.
Technical Support	
Help desk:	Students can access context sensitive help for any tool. The system includes online tutorials for students that help students learn how to use the system. In addition, Blackboard provides free orientation and training material for students and instructors that can be included in any courses. Additional training material may be licensed from Blackboard and customized by the institution.
Multi-languages support:	Blackboard Academic Suite is fully internationa lized and is available in 8 languages including language packs for English, Spanish, Italian, French, Simplified Chinese Japanese, Portuguese and German. A language pack editor enables clients to create their own language packs or edit existing languages and share them with their peers.
Pricing/Licensing	
Company profile:	Blackboard Inc. (NASDAQ: BBBB) is a leading provider of enterprise software applications and related services to the education industry. Founded in 1997, Blackboard enables educational innovations everywhere by connecting people and technology. Millions of people use Blackboard everyday at academic institutions around the globe, including colleges, universities, K-12 schools and other education providers, as well as textbook publishers and student-focused merchants that serve education providers and their students. Blackboard is headquartered in Washington, D.C., with offices in North America, Europe, Australia and Asia.
Cost:	The annual license fee is based on FTE students in an institution or consortium. Optional annual licenses, with three year terms are available.

Product Name: Blackboard
Version: 5.0
Company: Blackboard Inc.
URL: http://www.blackboard.com/
Developer: Blackboard
Contact Developer: For sales inquiries, call: (800) 424-9299, ext. 4

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surveys to collect feedback from Students. Blackboard offers useful feedback for instructors.
Self-assessing for students:	Instructors can create self-assessments for their students enrolled in the courses. They can provide personalized comments for essay/short answer questions, and can add comments to assessment results.
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. They can get reports showing the time and date and frequency students as an aggregated group accessed course content. They can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. The Performance Dashboard contains at-a-glance statistics about student access, grades, and Discussion Boar participation. The Early Warning System allows instructors to set rules for acceptable performance, and track students based on those rules. Students who appear to be at risk can be notified within the system, and notifications are tracked. Instructors can get reports showing the number of times and date on which each student accessed course content, discussion forums and assignments. Instructors can set a flag on individual course components to track the frequency with which students access those components.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. Students can create new rooms. Instructors may moderate chats and suspend students from the chat rooms. The chat tool supports a structured way for students to ask questions

	and instructors to provide answers. The system creates archive logs for all chat rooms. The Java-based chat tool supports unlimited simultaneous group discussions and private messages. Instructors may moderate chats and suspend students from the chat rooms. The system creates archive logs for all chat rooms. Instructors can view chat logs and share these with students. The virtual classroom tool supports a structured way for students to ask questions and instructors to provide answers.
Whiteboard:	The whiteboard supports image and PowerPoint uploading. The whiteboard supports mathematical symbols. The software supports group web browsing. The software supports application desktop sharing. The software can archive a recording of whiteboard sessions for future viewing. The software supports a whiteboard that can have multiple instances in the same course. The whiteboard supports mathematical symbols, and image and PowerPoint uploading. The software supports group web browsing. The software can archive a recording of whiteboard sessions for future viewing.
Asynchronous:	
Discussion forums:	A spell-checker is available for student and instructor responses. Discussions can be viewed by date, thread, or poster. Discussion threads are expandable and collapsible to view an entire conversation on one screen. Posts can contain URLs, file attachments and may contain HTML. The discussion software includes a formatting text editor which can create mathematic equations. Instructors can allow students to create discussion groups. They can set up moderated discussions where all posts are screened. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. Discussions can be shared across courses, departments, or any institutional unit. Instructors can associate a discussion with any course content. They can enable or disable anonymous posting, and determine whether student posts are re-editable and they can determine if threads are graded or un-graded. Instructors can enable peer rating, which uses a 5-star scale. Instructors can determine if threads are moderated – if so, control over moderation can be delegated to any user. They can view posting statistics to evaluate student participation and may create separate discussion environments for small groups of students and teaching assistants. Students can create online clubs, interest, and study groups at the system level. They can from different courses interact in system-wide chat rooms or discussion forums. If allowed, students can create online clubs, interest, and study groups. These groups can have their own catalog, templates, discussion boards, and more.
File sharing:	Students can submit assignments using drop boxes. They can share the contents of their personal folders with other students. Administrators can define disk space limitations for each user. Students have a private folder into which they can upload and

	download files. They can upload files to a shared group folder and can submit assignments using drop boxes. Instructors can upload files to the personal folder of a student. Students can also submit assignments to instructors via an integrated Assignment tool. Both Students and instructors can also exchange content outside of course boundaries. Students may access their folders and upload content using WebDAV. The system allows commenting, tracking, and versioning for documents. Instructors can share content with other instructors and students through a central learning objects repository. The repository can be system-wide or for individual organizational units. Tools are available to enable version tracking and linking to specific versions as well as the creation and management of workflows for collaborative content creation and review. The repository supports IEEE LOM and metadata application profiles such as, Dublin Core, Cancore, and custom profiles. The system supports sharing content across course and institution boundaries. The system provides a central content repository where course content files can be stored and accessed by other instructors. Instructors can designate their files to be private or publicly accessible. Content files can also be shared with specific groups or users as well as individuals outside of the system. Instructors can create links to content files in the central content repository so that changes made to the linked content are automatically displayed in their courses. Tools are available to enable version tracking and linking to specific versions as well as the creation and management of workflows for collaborative content creation and review. Instructors can describe course content using metadata. The repository supports IMS, Dublin Core, and custom tagging standards.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups and can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Students can use the Blackboard Messages (internal email) to email individuals in their courses. Emails can be sent to all users, users by role, or individual users. Students can attach files to emails, and emails can contain URLs, file attachments and may contain HTML.
Online journal:	Students can make private notes about their course and also use Portfolios to manage online journalizing.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site enrolled in, also can search within the glossary words.
Search within courses:	Students can search all course content, search all discussion threads and chat in virtual classroom session recordings by name or dates.

Calendar/ Progress Review:	Instructors and students can post events in the online course calendar. They can post announcements to a course announcement page. Students have a personal home page that lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. They can view their grades on completed assignments, total points possible, course grade, and compare their grades against the class performance. Instructors can post course-related events and announcements in the course calendar or to the course homepage. The instructor can assign tasks by using the calendar and can create an option that may enable the students to check their status at any point in a course. Students can check their grades on submitted assignments as well as compare their grades against the overall class performance.
Student profile:	Students can create and export a personal home page in each course. They can use their personal home page to display their course work. Personal home pages may include their photo, personal information, and links to important websites. Students may create portfolios, which can be private, shared with courses, shared with other users, or public. Students can contribute links, documents, or template-driven content to their portfolio, and can control the portfolio's look and feel. Thus portfolios can be exported.
Work offline:	Students can compile and download the content of an entire course into a format that can be printed or stored locally. Instructors can publish course content on a CD-ROM that can be linked dynamically through the online course or viewed offline. Students can download course content and discussion group content with a PDA. Students can download course content into a format that can be accessed on a mobile device and synchronize calendar events with a PDA.

C. Instructor Tools (Course Development):	
Online editor for course organization:	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. They can create linear learning sequences organized hierarchically by course, lesson, and topic. They can reuse courses as templates for future lessons. Also, instructors can create both linear and nonlinear learning sequences using a content library. They can access information and tips and tutorials on instructional design and on creating a collaborative learning environment. They can also create relationships between assignments and required resources which can then serve as templates for future lessons. The product provider also offers instructional design services for a fee to help instructors create their courses. Instructors can assign students to groups. The system can randomly create groups of a certain size or a set number of groups. Students can self-select groups. Each group can have its own discussion forum, can have its own chat or whiteboard, and can be given group-specific assignments or activities. Groups may be private

	or instructors can monitor groups. The software supports assigning students into groups by the instructor. Each group can have its own shared file exchange, private group discussion forum, synchronous tools, and group email list.
Online quiz editor:	Teachers can define a database of questions for re-use in different quizzes. Quiz questions and quiz answers can be randomized to reduce cheating.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments. They can set a time limit on a test and can permit multiple attempts. The students are allowed to review past attempts of a quiz. It supports a MathML editor for the inclusion of mathematical formulas in both questions and answers. Instructors can specify whether correct results are shown as feedback. The system supports proctored tests. Instructors can create different levels of feedback messages and can import questions from existing test banks. They can set dates and times while students must access tests. Instructors can use passwords to restrict access to tests. They can use the MathML and WebEQ equation editors to enable students to enter and edit mathematical notations. Instructors can create unit-specific tests or course-level tests and can provide personalized comments for essay/short answer questions. They can add comments to assessment results and can create extra-credit questions that can be scored separately. Instructors can differentially weigh tests and create grading rules. In addition they can choose the attempt(s) to include in the grade calculations. Instructors can override the automated scoring and determine how to communicate test results to students. Test types offered in Blackboard are: Multiple choice, Multiple answer, Matching, Ordering, Jumbled sentence, Calculated, Fill-in the blank, Short answer, Survey questions, and Essay. Questions can contain other media elements (images, videos, audio). Instructors can also create personal test banks and create system wide test banks. Questions can be imported from external test banks that support QTI. The system provides test analysis data. Instructors can create question pools and export and import those pools. The system provides analysis data for surveys and test item results can be exported for analysis.
Online grading:	Instructors can choose to mark each student on all questions or to mark each question on all students. They can choose to evaluate student responses anonymously. They can enable students to rate and comment on submissions of other students. Instructors and teaching assistants can mark paragraph questions, and mark and return assignments turned in through the Assignment tool. Instructors can provide feedback on quizzes and tests through annotations. When an instructor adds

	an assignment to the course, the software automatically adds it to the grade-book. Instructors can add grades for offline assignments. They can add details to the grade-book in custom columns. They can export the scores in the grade-book to an external spreadsheet and they can create a course grading scale that can employ either percents, letter grades, or pass/fail metrics. Instructors can add the grades for offline assignments to the online grade-book. They can sort and view grades in the grade-book by assignment, by student, by category and for all students on all assignments. Instructors can import and export a comma-delimited version of the grade-book from/to an external spreadsheet program. They can search the grade-book to find all students who meet a specific performance criteria, mark, or status such as exam completion. Instructors can create a course grading scale that can employ raw scores, percentages, letter grades or pass/fail metrics. When an instructor adds an assessment or assignment to the course, the software automatically adds it to the grade-book. The grade-book supports the creation of custom columns which can contain either grade information or other instructor-determined details. Instructors can delegate the responsibility for grading assignments. Instructors can manually edit all grades. The software automatically calculates the average grade on each assignment. Instructors can download the results of a test across sections of a course and across semesters. They can aggregate data and perform item-level analysis of individual survey items across the entire system.
23. Course templates:	The software provides support for template-based course creation. The system provides course design wizards that provide step-by-step guides that take faculty and course designers through the completion of common course tasks, such as setting up the course homepage, syllabus, organizer pages, content modules, discussion. Course content may be uploaded through WebDAV. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course. Instructors can use templates to create course content. Content can be uploaded through WebDAV or a form. The templates include a rich text content editor. Instructors can categorize course content as announcements, calendar entries, course units, discussion forums, handouts, instructor biography, lecture notes, links, syllabus and course descriptions, tips, FAQs and resources. Instructors can create new content templates. A Course Creation Wizard enables instructors to easily set up a course using templates.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. Instructors can release materials based on a single criteria (date, grade, etc.) or instructors can use Boolean expressions to identify multiple selective release criteria. They can set up specific course content that is released on a specific date and

	must be completed by students before they continue with the course. They can link discussions to specific dates or course events. They can personalize access to specific course materials based on group membership. They can personalize access to specific course materials based on previous course activity. They can personalize access to specific course materials based on student performance. They can selectively release assessments, announcements and other materials based on previous course activity, previous grade, or specific start and end dates. Instructors can specify start and stop dates for the entire course or for specific materials
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course. They can change the order and name of menu items for a course. They can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look and feel templates as well as institutional images, headers and footers. They can apply their own institutional images, headers and footers across all courses. Instructors can change the navigation icons and color schemes and the order, name, and function of menu items for a course. Through domains, a system can support multiple institutions, departments or schools on a single installation, including images, headers and footers as well as courses, users, and roles.

E. Administrator Tools:	
Authentication:	Administrators can allow guest access to all courses. The system can authenticate against an external LDAP server, can authenticate using the Kerberos protocol, supports Shibboleth, and supports the Central Authentication Service (CAS). Administrators can set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server) fails. The system can support multiple organizational units and virtual hosts within a server configuration. Administrators can set courses to be publicly accessible or protect access to individual courses with a username and password. The system can also authenticate against an external LDAP server, Active Directory, Microsoft's .NET Passport Web Service, or using other protocols (Kerberos, Shibboleth, and CAS have been implemented). SIF is also compatible. User sessions can be encrypted with SSL. Administrators can set up fail-through authentication against multiple sources in the event that the primary source fails. Passwords stored in the system database are encoded.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Administrators

	can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. Administrators can distribute the permissions and roles across multiple institutions or departments hosted in the server environment. Instructors or students may be assigned different roles in different courses. Administrators can create multiple domains, designate users, courses, roles, and brands to each domain. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. Instructors or students may be assigned different roles in different courses. Administrators and Instructors can assign different levels of access to the system or to specific courses based on pre-defined roles. Administrators can delegate administration of the system to different organizational entities within an institution or consortia. The system can access authorization information stored in an LDAP directory.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can batch add students to the system using a delimited text file. Administrators can transfer student information bidirectional between the system and an SIS using delimited text files. The software supports data interchange with student information systems through an event-driven API. The software supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. The software is compliant with the IMS Enterprise Specification for Student Data. Administrators and Instructors can batch add students to a course using a delimited text file or students can self-register. Administrators can batch create courses, users, and enrollments in the system. The software supports integration with student information systems through an event-driven API or through their tool which is based on scheduled system extracts. Administrators can transfer student information bi-directionally between the system and an SIS in batch or in real time. The system supports the use of SOAP-based data integration. Integration with Student Information Systems is available through existing plug-ins. The service provider will assist, as a services engagement, in transferring student registration information between the CMS and the institutional SIS. The software is compliant with the IMS Enterprise specification for student data.
Course creation, duplication, and deletion:	Instructors can create, edit, and duplicate, any one of their courses. Also the administrator can do the same.
Statistics:	Usage of statistics can be aggregated across courses or across the institution.

First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	A full browser matrix is available. Compatible browsers for Windows 2000 include IE 6.0, Netscape 7.1 and 8.0, Firefox 1.0. Compatible browsers for Windows XP include IE 7.0, and Netscape 7.1. Compatible browsers for Mac OS 10.2 and 10.3 include IE 5.2, Netscape 7.1, Firefox 1.0, Safari 1.0, 1.1, 1.2 and 2.0.
Database required:	The system supports Oracle, MS SQL Server, and MySQL.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.
Technical Support	
Help desk:	The system includes online tutorials for students that may help them learn how to use the system. Students can access online tutorials, a student manual, the product knowledge base, and the product reference center.
Multi-languages support:	Blackboard Academic Suite is fully internationalized and is available in 8 languages including language packs for English, Spanish, Italian, French, Simplified Chinese Japanese, Portuguese and German. A language pack editor enables clients to create their own language packs or edit existing languages and share them with their peers.
Pricing/Licensing	
Company profile:	Founded in 1997, Blackboard is a public company (NasdaqNM:BBBB) that has over the years acquired CourseInfo, Web-Course-in-a-Box, Prometheus, and WebCT CMSs. The Company's product line consists of the Blackboard Academic Suite (including the Blackboard Learning System, Blackboard Community System, and Blackboard Content System) and the Blackboard Commerce Suite. Blackboard is headquartered in Washington, D.C.
Cost:	The annual license fee is based on FTE students in an institution (or school within an institution) or consortium. In some markets, the annual license fee is determined on a per-user basis.

Product Name:	Blackboard
Version:	CE 6.0
Company:	Blackboard Inc.
URL:	http://www.blackboard.com/
Developer:	Blackboard
Contact Developer:	For sales inquiries, call: (800) 424-9299, ext. 4

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surveys to collect feedback from Students. Blackboard offers useful feedback for instructors.
Self-assessing for students:	Instructors can create self-assessments to their students enrolled in the courses. They can provide personalized comments for essay/short answer questions, and can add comments to assessment results.
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. They can get reports showing the time and date and frequency students as an aggregated group accessed course content. They can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. They also can review the navigation record of each student. Usage of statistics can be aggregated across courses or across the institution. Instructors can export all students tracking data and share tracking information with students.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. Instructors may moderate chats and suspend students from the chat rooms. The chat tool supports a structured way for students to ask questions and instructors to provide answers. The system creates archive logs for all chat rooms. The system does not limit the number of simultaneous rooms. Students can see who else is online across the entire system and invite them to a chat room. That is combined with whiteboard tool, see whiteboard description for more information.

Audio/Video conferencing:	Audio/Video conferencing is available with the chat service.
Whiteboard:	The whiteboard supports image and PowerPoint uploading. It supports mathematical symbols. The software can archive a recording of whiteboard sessions for future viewing. Whiteboard usage can be moderated, and is combined with the chat tool (see chat description for more information).
Asynchronous:	
Discussion forums:	A spell-checker is available for student and instructor responses. Discussion forums can be threaded, blog format or journals (individual or group). Discussion forums can be viewed by topic, by date, and by thread. Discussion threads are expandable and collapsible to view an entire conversation in one screen. Instructors can associate a discussion with any course content. Posts can contain URLs, file attachments and may contain HTML. The threaded discussion software includes a formatting text editor which can create mathematic equations. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. Discussion topics can be made gradable and a grading interface provided. Grading can be assigned by grading form (rubric), numeric or alphanumeric grade. Instructors can limit discussions to specific time periods. Instructors can enable or disable anonymous posting, and determine whether student posts are re-editable .Discussions can be saved or printed for off-line reading.
File sharing:	Students can submit assignments using drop boxes. Administrators can define disk space limitations for each user. Students have a private folder into which they can upload and download files. They may access their folders using WebDAV.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. They can use a searchable address book . Instructors can email the entire class at once at a single address or alias. Students can elect to forward their mail to an external address. The internal email system supports archiving, searching and attachments. Students can spell check outgoing messages.
Online journal:	Students can attach notes to any page. They can combine their notes with the course content to create a printable study guide. Journal discussion type provides a way for students to share notes and thoughts with the instructor and or other students.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site enrolled in, also can search within the glossary words.
Search within courses:	Students can search all course content. They can search all discussion threads. Also, they can search all assignments, course content, discussion threads, and email messages in their course. Students can constrain a search using filters.

Calendar/ Progress Review:	Instructors and students can post events in the online course calendar. They can post announcements to a course announcement page. Students have a personal home page that lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. They can view their grades on completed assignments, total points possible, course grade, and compare their grades against the class performance. Calendar entries can be linked to course materials and activities. Events can be repeating. Institutional calendar events and announcements can be added as well.
Student profile:	Students can create a personal home page in each course. They can use their personal home page to selectively display their course work. They can export their personal home page. Also they are given a private folder for content by default. A personal profile tool is included in the product and empowers students to choose what information to share with classmates. The Blackboard Portfolio for CE and Vista is available at additional cost and provides additional features for creating a personal portfolio.
Work offline:	Students can compile and download the content for an entire course into a format that can be printed or stored locally. Instructors can publish course content on a CD-ROM that can be linked to dynamically through the online course or viewed offline.

C. Instructor Tools (Course Development):	
Online editor for course organization:	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. They can create linear learning sequences organized hierarchically by course, lesson, and topic. And they can reuse courses as templates for future lessons. All items can be conditionally released to provide appropriate progression or remediation as needed, based on time, grade book criteria, group membership and user ID. Instructors can assign students to groups. The system can randomly create groups of a certain size or a set number of groups. Students can self-select groups. Each group can have its own discussion forum, can have its own chat or whiteboard, and can be given group-specific assignments or activities. Groups may be private or instructors can monitor groups. Instructors can selectively release any course content or activity to a group.
Online quiz editor:	Teachers can define a database of questions for re-use in different quizzes. Quiz questions and quiz answers can be randomized to reduce cheating.
Grade distribution:	Blackboard allows a grade distribution tool for each group of students in specific course. Instructors can benefit from the useful statistics about the grades.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments and set a time limit on a test. They can permit multiple attempts. The students are allowed to review past attempts of a quiz. Instructors can specify whether correct results are shown as feedback. The system supports proctored tests. The system supports a MathML editor for the inclusion of mathematical formulas in questions. Test access can be restricted by IP range. Test types offered in Blackboard: Multiple choice, Multiple answer, Matching, Jumbled sentence, Calculated, Fill-in the blank, Short answer, Survey questions, and Essay. Questions can contain other media elements (images, videos, audio). Instructors can create personal test banks. Questions can be imported from external test banks that support QTI. The system provides test analysis data.
Online grading:	Instructors can choose to mark each student on all questions or to mark each question on all students. They can choose to evaluate student responses anonymously. and can enable them to rate and comment on submissions of other students. When an instructor adds an assignment to the course, the software automatically adds it to the grade-book. Instructors can add grades for offline assignments. They can add details to the grade-book in custom columns and can export the scores in the grade-book to an external spreadsheet. They can create a course grading scale that can employ either percents, letter grades, or pass/fail metrics. Gradable assignments, discussions and assessments are automatically added to the grade-book when added to a course. Name columns are frozen on left when scrolling grade book.
Course templates:	The software provides support for template-based course creation. Course content may be uploaded through WebDAV. Course templates may contain selective release criteria and custom grade-book columns that persist with each new course instance. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates, can release materials based on a single criteria (date, grade, etc.) or instructors can use Boolean expressions to identify multiple selective release criteria, can set up specific course content that is released on a specific date and must be completed by students before they continue with the course, can link discussions to specific dates or course events, can personalize access to specific course materials based on group membership, can personalize access to specific course materials based on previous course activity and can personalize access to specific course materials based on student performance. Program and institutional goals may be specified using the "Goals" tool and tied to particular activities in the course.

Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course. They can change the order and name of menu items of a course and create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers.

E. Administrator Tools:	
Authentication:	The system can authenticate against an external LDAP server and can authenticate using the Kerberos protocol. The system supports Shibboleth and the Central Authentication Service (CAS). It also can authenticate against IMAP, POP3 or secure NNTP. Administrators can set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server) fails. The system can support multiple organizational units and virtual hosts within a server configuration.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. They can distribute the permissions and roles across multiple institutions or departments hosted in the server environment. Instructors or students may be assigned different roles in different courses.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can transfer student information bidirectional between the system and an SIS using IMS Enterprise Specification v1.1 XML files via web services. The software supports data interchange with student information systems through an event-driven API. and it supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. It is compliant with the IMS Enterprise Specification for Student Data.
Course creation, duplication, and deletion:	Instructors can create, edit, and duplicate any of their courses. The administrator can also do the same.
Course and web site back-up:	Administrators or instructors with appropriate permissions can use the backup restore functions to create, transfer or restore parts of an existing course or a whole course.
Statistics:	Usage statistics can be aggregated across courses or across the institution.
First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	For the Windows 2000 operating system, the following browsers are compatible: IE 6.0, Netscape 7.1 and 8.0, and Firefox 1.0. For Windows XP, the following browsers are compatible: IE 6.0 and 7.0, Netscape 7.1 and 8.0, and Firefox 1.0. For Mac OS 10.2, 10.3, and 10.4, compatible browsers include: IE 5.2, Netscape 7.1, Firefox 1.0, Safari 1.1, 1.2 and 1.3. A full browser matrix is available.
Database required:	The system supports Oracle and MS SQL Server.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.
Technical Support	
Help desk:	Students can access context sensitive help for any tool. The system including online tutorials helps students who learn how to use the system.
Multi-languages support:	Blackboard Academic Suite is fully internationalized and is available in 8 languages including language packs for English, Spanish, Italian, French, Simplified Chinese Japanese, Portuguese and German. A language pack editor enable s clients to create their own language packs or edit existing languages and share them with their peers.
Pricing/Licensing	
Company profile:	Blackboard Inc. (NASDAQ: BBBB) is a leading provider of enterprise software applications and related services to t he education industry. Founded in 1997, Blackboard enables educational innovations everywhere by connecting people and technology. Millions of people use Blackboard everyday at academic institutions around the globe, including colleges, universities, K-12 schools and other education providers, as well as textbook publishers and student-focused merchants that serve education providers and their students. Blackboard is headquartered in Washington, D.C., with offices in North America, Europe, Australia and Asi a.
Cost:	The annual license fee is based on FTE students in an institution or consortium. Optional annual licenses, with three year terms are available.

Product Name: Blackboard
Version: CE 7.0
Company: Blackboard Inc.
URL: http://www.blackboard.com/
Developer: Blackboard
Contact Developer: For sales inquiries, call: (800) 424-9299, ext. 4

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives of each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surveys to collect feedback from Students. Blackboard offers useful feedback for instructors.
Self-assessing for students:	Instructors can create self-assessments for their students enrolled in the courses. They can provide personalized comments for essay/short answer questions, and can add comments to assessment results.
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. They can get reports showing the time and date and frequency students as an aggregated group accessed course content. They also can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. The Performance Dashboard contains at-a-glance statistics about student access, grades, and Discussion Boar participation. The Early Warning System allows instructors to set rules for acceptable performance, and track students based on those rules. Students who appear to be at risk can be notified within the system, and such notifications are tracked. Instructors can get reports showing the number of times and date on which each student accessed course content, discussion forums and assignments. Instructors can set a flag on individual course components to track the frequency with which students access those components.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions and students can create new rooms. Instructors may moderate chats and suspend students from the chat rooms. The chat tool supports a structured way for students to ask questions

	and instructors to provide answers. The system creates archive logs for all chat rooms. The Java-based chat tool supports unlimited simultaneous group discussions and private messages. Instructors may moderate chats and suspend students from the chat rooms. Instructors can view chat logs and share these with students. The virtual classroom tool supports a structured way for students to ask questions and instructors to provide answers.
Audio/Video conferencing:	Audio/Video conferencing is available with the chat service.
Whiteboard:	The whiteboard supports image and PowerPoint uploading and also supports mathematical symbols. The software supports group web browsing and application desktop sharing. It can archive a recording of whiteboard sessions for future viewing. The software supports a whiteboard that can have multiple instances in the same course and also supports mathematical symbols, image and PowerPoint uploading. In addition it supports group web browsing and can archive a recording of whiteboard sessions for future viewing.
Asynchronous:	
Discussion forums:	A spell-checker is available for student and instructor responses. Discussions can be viewed by date, thread, or poster. Discussion threads are expandable and collapsible to view an entire conversation on one screen. Discussion threads can be searched. Posts can contain URLs, file attachments and may contain HTML. The discussion software includes a formatting text editor which can create mathematic equations. Instructors can allow students to create discussion groups. They can set up moderated discussions where all posts are screened. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. They can associate a discussion with any course content and can enable or disable anonymous posting, and determine whether student posts are re-editable. Instructors can determine if threads are graded or un-graded and can enable peer rating, which uses a 5-star scale. They can determine if threads are moderated – if so, control over moderation can be delegated to any user. Instructors can view posting statistics to evaluate student participation and they may create separate discussion environments for small groups of students and teaching assistants. Students can create online clubs, interest, and study groups at the system level. From different courses they can interact in system-wide chat rooms or discussion forums. If allowed, students can create online clubs, interest, and study groups.
File sharing:	Students can submit assignments using drop boxes. They can share the contents of their personal folders with other students. They have a private folder into which they can upload and download files. Students can upload files to a shared group folder and can submit assignments using drop boxes.

	Instructors can upload files to the personal folder of a student.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. They can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Also, they can use Blackboard Messages (internal email) to email individuals, groups, or all users with a specific role in their courses. Students can attach files to emails, and emails can contain URLs, file attachments and may contain HTML.
Online journal:	Students can make private notes about their course.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site enrolled in, also can search within the glossary words.
Search within courses:	Students can search all discussion threads and search chat or virtual classroom session recordings. They can search all Discussion Boards, as well as chat or virtual classroom session recordings by name or dates.
Calendar/ Progress Review:	Instructors and students can post events in the online course calendar. They can post announcements to a course announcement page and have a personal home page that lists all courses, in which the student is enrolled, new email and all course and system-wide events from their personal calendar. Students can view their grades on completed assignments, total points possible, course grade, and compare their grades against the class performance. Instructors can post course-related events and announcements in the course calendar or to the course homepage. They can assign tasks by using the calendar and can enable an option which enables the student to check their status at any point in a course. Students can check their grades on submitted assignments as well as compare their grades against the overall class performance.
Student profile:	Students can create a personal home page in each course. They can create a personal home page which may include a photo, personal information, and links to important websites.
Work offline:	Students can compile and download the content for an entire course into a format that can be printed or stored locally. Instructors can publish course content on a CD-ROM that can be linked to dynamically from within the online course or viewed offline. Students can download course content and discussion group content with a PDA. course or viewed offline. Students can download course content into a format that can be accessed on a mobile device and synchronize calendar events with a PDA.

C. Instructor Tools (Course Development):	
Online editor for course organization:	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. They can create linear learning sequences organized hierarchically by course, lesson, and topic. They can reuse courses as templates

	for future lessons. They also can create both linear and nonlinear learning sequences using a content library. Instructors can access information and tips and tutorials on instructional design and on creating a collaborative learning environment. They can create relationships between assignments and required resources which can then serve as templates for future lessons. The product provider also offers instructional design services for a fee to help instructors create their courses.
Online quiz editor:	Teachers can define a database of questions for re-use in different quizzes. Quiz questions and quiz answers can be randomized to reduce cheating.
Grade distribution:	Blackboard allows a grade distribution tool for each group of students in specific course. Instructors can benefit from the useful statistics about the grades .

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments and can set a time limit on a test. They can permit multiple attempts. The students are allowed to review past attempts of a quiz. The system supports a MathML editor for the inclusion of mathematical formulas in both questions and answers. Instructors can specify whether correct results are shown as feedback. The system supports proctored tests. Instructors can create different levels of feedback messages and they can import questions from existing test banks. Instructors can set dates and times when students must access tests. They can use passwords to restrict access to tests and use the MathML and WebEQ equation editors to enable students to enter and edit mathematical notations. Instructors can create unit-specific tests or course-level tests and provide personalized comments for essay/short answer questions, and then can add comments to assessment results. Instructors can create extra-credit questions that can be scored separately and differentially weigh tests and create grading rules. They can choose which attempt(s) are to include in the grade calculations. Instructors can override the automated scoring and determine how to communicate test results to students. Test types available in Blackboard are: Multiple choice, Multiple answer, Matching, Ordering, Jumbled sentence, Calculated, Fill-in the blank, Short answer, Survey questions, and Essay. Questions may contain other media elements (images, videos, audio). Instructors can create personal test banks and system wide test banks. The system provides test analysis data. Instructors can create question pools, and export and import those pools. The system provides analysis data for surveys and test item results can be exported for analysis.
Online grading:	Instructors and teaching assistants can mark paragraph questions, and mark and return assignments turned in through

	the assignment drop-box. They can provide feedback on all assignments through annotations. Instructors can publish student submissions as examples for other students to see. When an instructor adds an assignment to the course, the software automatically adds it to the grade-book. Besides, instructors can add grades to offline assignments and add details to the grade-book in custom columns. They can export the scores in the grade-book to an external spreadsheet and create a course grading scale that can employ either percents, letter grades, or pass/fail metrics. Instructors can add the grades for offline assignments to the online grade-book. They can sort and view grades in the grade-book by assignment, by student, by category and for all students on all assignments. Instructors can import and export a comma-delimited version of the grade-book from/to an external spreadsheet program. Instructors can search the grade-book to find all students who meet a specific performance criteria, mark, or status such as exam completion. They also can create a course grading scale that may employ raw scores, percentages, letter grades or pass/fail metrics. When an instructor adds an assessment or assignment to the course, the software automatically adds it to the grade-book. The grade-book supports the creation of custom columns which can contain either grade information or other instructor-determined details. Instructors can delegate the responsibility for grading assignments and edit all grades manually. The software automatically calculates the average grade on each assignment. Instructors can download the results of a test across sections of a course and across semesters, aggregate data and perform item-level analysis of individual survey items across the entire system.
Course templates:	The software provides support for template-based course creation. The system provides course design wizards that provide step-by-step guides that take faculty and course designers through the completion of common course tasks, such as setting up the course homepage, syllabus, organizer pages, content modules, and discussion. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course. Instructors can use templates to create course content. The templates include a rich text content editor. Instructors can categorize course content as announcements, calendar entries, course units, discussion forums, handouts, instructor biography, lecture notes, links, syllabus and course descriptions, tips, FAQs and resources. They also can create new content templates. A Course Creation Wizard enables instructors to easily set up a course using templates.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. Instructors can release materials based on a single criteria (date, grade, etc.) or instructors can use Boolean expressions to

	identify multiple selective release criteria, can set up specific course content that is released on a specific date and must be completed by students before they continue with the course, can link discussions to specific dates or course events, can personalize access to specific course materials based on group membership, can personalize access to specific course materials based on previous course activity, and can personalize access to specific course materials based on student performance. In addition to that, instructors can selectively release assessments, announcements and other materials based on previous course activity, previous grade, or specific start and end dates. Instructors can specify start and stop dates for the entire course or for specific materials.
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course. They can change the order and name of menu items for a course and can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. Institutions can apply their own institutional images, headers and footers across all courses. Instructors can change the navigation icons and color schemes and the order, name, and function of menu items for a course.

E. Administrator Tools:	
Authentication:	Administrators can allow guest access to all courses. The system can authenticate against an external LDAP server, can authenticate using the Kerberos protocol, supports Shibboleth, supports the Central Authentication Service (CAS), and can authenticate against IMAP, POP3 or secure NNTP. Administrators can set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server) fails. They also can set courses to be publicly accessible or protect access to individual courses with a username and password. The system can also authenticate against an external LDAP server, Active Directory, Microsoft's .NET Passport Web Service, or using other protocols (Kerberos, CAS and Shibboleth have been implemented). SIF is compatible. User sessions can be encrypted with SSL. Administrators can set up fail-through authentication against multiple sources in the event that the primary source fails. Passwords stored in the system database are encoded.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Instructors or students may be assigned different roles in different courses. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. Instructors or students may be assigned different roles in different courses. Administrators and

	Instructors can assign different levels of access to the system or to specific courses based on pre-defined roles. The system can access authorization information stored in an LDAP directory.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can batch add students to the system using a delimited text file. They can transfer student information bidirectional between the system and an SIS using delimited text files. The software supports data interchange with student information systems through an event-driven API. It supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. The software is compliant with the IMS Enterprise Specification for Student Data. Administrators and Instructors can batch add students to a course using a delimited text file or students can self-register. Administrators can batch create courses, users, and enrollments in the system. The software supports integration with student information systems through an event-driven API or through their tool which is based on scheduled system extracts. Administrators can transfer student information bi-directionally between the system and an SIS in batch or in real time. The system supports the use of SOAP-based data integration. Integration with Student Information Systems is available through existing plug-ins. The service provider will assist, as a services engagement, in transferring student registration information between the CMS and the institutional SIS. The software is compliant with the IMS Enterprise specification for student data.
Course creation, duplication, and deletion:	Instructors can create, edit, and duplicate any of their courses. The administrator can also do the same.
Course and web site back-up:	Administrators or instructors with appropriate permissions can use the backup restore functions to create, transfer or restore parts of an existing course or a whole course.
Statistics:	Usage of statistics can be aggregated across courses or across the institution.
First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	For the Windows 2000 operating system, the following browsers are compatible: IE 6.0, Netscape 7.1 and 8.0, and Firefox 1.0. For Windows XP, the following browsers are compatible: IE 6.0 and 7.0, Netscape 7.1 and 8.0, and Firefox 1.0. For Mac OS 10.2, 10.3, and 10.4, compatible browsers

	include: IE 5.2, Netscape 7.1, Firefox 1.0, Safari 1.1, 1.2 and 1.3. A full browser matrix is available.
Database required:	The system supports Oracle and MS SQL Server.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available
Technical Support	
Help desk:	The system includes online tutorials that may help students learn how to use the system. Students can access online tutorials, a student manual, the product knowledge base, and the product reference center.
Multi-languages support:	Blackboard Academic Suite is fully internationalized and is available in 8 languages including language packs for English, Spanish, Italian, French, Simplified Chinese Japanese, Portuguese and German. A language pack editor enables clients to create their own language packs or edit existing languages and share them with their peers.
Pricing/Licensing	
Company profile:	Founded in 1997, Blackboard is a public company (NasdaqNM:BBBB) that has over the years acquired CourseInfo, Web-Course-in-a-Box, Prometheus, and WebCT CMSs. The Company's product line consists of the Blackboard Academic Suite (including the Blackboard Learning System, Blackboard Community System, and Blackboard Content System) and the Blackboard Commerce Suite. Blackboard is headquartered in Washington, D.C.
Cost:	The annual license fee is based on FTE students in an institution (or school within an institution) or consortium. In some markets, the annual license fee is determined on a per-user basis.

Product Name: Claroline
Version: 1.8.1
Company: Claroline
URL: http://www.claroline.net/
Developer: Claroline
Contact Developer: info@claroline.net – Tel: 32 (0)498 43 03 28

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	Teachers receive a mail on new submission and students receive a mail on teacher's feedback.
Self-assessing for students:	Instructors can create self-assessments.
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. They can get reports showing the time and date and frequency students as an aggregated group accessed course content, also get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. The system creates archive logs for all chat rooms.
Asynchronous:	
Discussion forums:	Instructors can allow students to create discussion groups. They can set up moderated discussions where all posts are screened. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. Students can enable or disable posts to be sent to their email. Spell-checker is available in new web browser like Mozilla Firefox 2.0.
File sharing:	Students can submit assignments using drop boxes. Each course space have is assignment tool.
Internal e-mail:	Instructors can email the entire class at once at a single address or alias.

Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to group of all courses in the site.
Search within courses:	Students can search across all courses they are enrolled in and not enrolled with a single search. They can search all discussion threads.
Calendar/ Progress Review:	Instructors can post announcements to a course announcement page. Students have a personal home page that lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. They can subscribe to RSS feeds to be notified of changes to materials.
Student profile:	All the information of a student is summarized in one page. The teacher accesses the student profile through the user list. The student can't view his profile. Personal information (card id, name, surname address, phone number, etc.) and user photograph is shown on the top. This is the unique place where the teacher can modify the student name. The teacher can add private comments in a text box (only the teachers can see this information). Below this information the teacher can find all the student marks in the subject.

C. Instructor Tools (Course Development):	
Online editor for course organization:	Instructors can assign students to groups. The system can randomly create groups of a certain size or a set number of groups. Students can self-select groups. Each group can be given group-specific assignments or activities. Groups may be private or instructors can monitor groups.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments and can set a time limit on a test. They also can permit multiple attempts. The students are allowed to review past attempts of a quiz. Instructors can specify whether correct results are shown as feedback. Test types available in Claroline: Multiple choices, Multiple answer, Matching, and Fill-in the blank. Questions can contain other media elements (images, videos, audio). Instructors can create personal test banks. Questions can be imported from external test banks that support QTI.
Course templates:	Institutions can create their own templates for their courses.
Curriculum management:	Course manager can export Wiki to HTML File. It can add a key on enrolment and a text to explain procedure to join a locked course or a course protected by a key
Customize look and feel:	Institutions can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers.

Automated glossary:	This tool allows creation of a simple glossary. The teacher can add, modify and delete the entries and definitions of the glossary

E. Administrator Tools:	
Authentication:	Administrators can allow guest access to all courses. The system can authenticate against an external LDAP server. The system can authenticate using the Kerberos protocol, supports Shibboleth and also supports the Central Authentication Service (CAS). Furthermore, the system can authenticate against IMAP, POP3 or secure NNTP. Administrators can set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server) fails.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. Instructors or students may be assigned different roles in different courses.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can batch add students to the system using a delimited text file.
Student transcript:	Student is able to view/print a transcript of the courses they enrolled in.
Course creation, duplication, and deletion:	Instructors can create, edit, duplicate, any of their course. The administrator also can do the same.
Course and web site back-up:	Instructors can make back-up for their own courses in an easy way.
Statistics:	Usage of statistics can be aggregated across courses or across the institution. Student statistics shows the connection and assessment statistics. It shows the same information as in the User Statistics.

F. Technical Specification:	
Hardware/Software	
Client browser required:	Any popular browser is available to access ATutor.
Database required:	The system supports MySQL. The application requires only one database and can coexist with tables from other applications.
Technical Support	
Help desk:	ATutor has a help desk to help instructors and students.

Pricing/Licensing	
Company profile:	Claroline Learning Content Management System.
Open source:	The software is distributed under one of the OSI -approved licenses.

Product Name: Moodle
Version: 1.7
Company: Moodle
URL: http://www.moodle.org/
Developer: Moodle.org
Contact Developer: http://moodle.com/helpdesk/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct .
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surve ys to collect feedback from Students. It is smaller in scope and therefore easier to use than the Questionnaire module, and unlike the Survey tool allows you to write your own questions, rather than choose from a list of pre -written survey instruments.
Self-assessing for students:	Instructors can create self -assessments for all students in his/her own courses. Students can upload their assignments to the server -they are date- stamped. Advanced assignments can allow multiple files to be uploaded.
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. They can get reports showing the time and date and frequency students as an aggregated group accessed cours e content. Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. Instructors may moderate chats and suspend students from the chat rooms. The system creates archive logs for all chat rooms.
Asynchronous:	
Discussion forums:	Students can enable or disable posts to be sent to their email. They can receive posts by email as daily digests of subject lines or whole posts and subscribe to forum RSS feeds. A spell - checker is available for student and instructor responses. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades.

File sharing:	Students can submit assignments using drop boxes. They can upload files to their blog and share them with other users via the blog. Instructors can make complete copies of entire courses and/or individual items in courses, and share them with other instructors.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site also can search within the glossary words.
Search within courses:	Students can search all course content and search across all courses they are enrolled in with a single search.
Calendar/ Progress Review:	Instructors can post announcements to a course announcement page. Students can view their grades on completed assignments, total points possible, course grade, and compare their grades against the class performance.
Student profile:	Students can create a personal home page in each course.
Work offline:	Students can benefit from the materials offered by instructors to get the knowledge offline.

C. Instructor Tools (Course Development):	
Online editor for course organization:	Instructors can reuse courses as templates for future lessons. They can organize learning objects, course tools, and content into learning sequences that are reusable. Also can create linear learning sequences organized hierarchically by course, lesson, and topic and reuse courses as templates for future lessons. Instructors can assign students to groups. Each group can have its own discussion forum, can have its own chat or whiteboard, and can be given group-specific assignments or activities.
Online quiz editor:	Teachers can define a database of questions for re-use in different quizzes. Questions can be stored in categories for easy access, and these categories can be "published" to make them accessible from any course on the site. Quiz questions and quiz answers can be shuffled (randomized) to reduce cheating. Questions allow HTML and images.
Grade distribution:	Moodle allows a grade distribution tool for each group of students in specific course.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments, set a time limit on a test. Instructors can permit multiple attempts, and specify whether correct results are shown as feedback. Test types available in Moodle are: Multiple choices, Multiple answer, Matching, Fill-in the blank, Short answer, and Essay. Questions can contain other media elements (images, videos, audio).
Online grading:	Instructors can choose to mark each student on all questions or to mark each question on all students. They can enable students to rate and comment on submissions of other students. When an instructor adds an assignment to the course, the software

	automatically adds it to the grade-book. Instructors can add grades for offline assignments and export the scores in the grade-book to an external spreadsheet. They can create a course grading scale that can employ either percents, letter grades, or pass/fail metrics.
Course templates:	The software provides support for template-based course creation. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. They can personalize access to specific course materials based on group membership.
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course. They can change the order and name of menu items for a course and create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look and feel templates as well as institutional images, headers and footers.
Automated glossary:	This activity allows participants to create and maintain a list of definitions, like a dictionary. The entries can be searched or browsed in many different formats. The glossary also allows teachers to export entries from one glossary to another (the main one) within the same course. If glossary auto-linking is enabled by an administrator then it is possible to automatically create links to these entries from throughout the course.

E. Administrator Tools:	
Authentication:	Administrators can allow guest access to all courses. The system can authenticate against an external LDAP server.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Instructors or students may be assigned different roles in different courses.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can batch add students to the system using a delimited text file. They can transfer student information bidirectional between the system and an SIS using delimited text files.
Course creation, duplication, and deletion:	Instructors can create, edit, duplicate, any one of their course. The administrator also can do the same.
Course and web site back-up:	Moodle has a course backup and restore process. Each successive version of Moodle has offered more options in this process. An administrator or user with appropriate permissions

	can use the backup restore functions to create, transfer or restore parts of an existing course or a whole course.
Statistics:	Usage statistics can be aggregated across courses or across the institution.
First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	All major web browsers work fine.
Database required:	The system supports MySQL.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.
Technical Support	
Help desk:	Students can access context sensitive help for any tool.
Multi-languages support:	Moodle offers over 70 languages.
Pricing/Licensing	
Company profile:	Moodle.org is an open source community launched in 2001 that has grown out of a PhD research project by Martin Dougiamas. Version 1.0 was released on August 20, 2002. Moodle.com is a company launched in 2003 that sponsors Moodle development and provides commercial support, hosting, custom development, and consulting. The Moodle Partners are a network of companies that work with Moodle.com to provide services around the world.
Cost:	Free
Open source:	The software is distributed under one of the OSI-approved licenses.

Product Name: Moodle
Version: 1.8
Company: Moodle
URL: http://www.moodle.org/
Developer: Moodle.org
Contact Developer: http://moodle.com/helpdesk/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surveys to collect feedback from Students. It is smaller in scope and therefore easier to use than the Questionnaire module, and unlike the Survey tool allows you to write your own questions, rather than choose from a list of pre-written survey instruments. Teacher feedback is appended to the assignment page for each student, and notification is mailed out.
Self-assessing for students:	Instructors can create self-assessments for all students in his/her own courses. Students can upload their assignments to the server -they are date- stamped. Advanced assignments can allow multiple files to be uploaded. This could keep together preplanning maps, outlines, research papers and presentations. (Not for beginners).
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. Instructors can review the navigation record of each student. Usage of statistics can be aggregated across courses or across the institution.

B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. Students can create new rooms. The system creates archive logs for all chat rooms. All sessions are logged for later viewing, and these can also be made available to students.
Audio/Video conferencing:	Audio/Video conferencing is available with the chat service.

Whiteboard:	There are several optional add-ons with whiteboard capabilities such as Elluminate and DimDim.
Asynchronous:	
Discussion forums:	Students can enable or disable posts to be sent to their email. They can receive posts by email as daily digests of subject lines or whole posts. Students can subscribe to forum RSS feeds. A spell-checker is available for student and instructor responses. Granular roles system enables students to be set as administrator of individual forums in a course. Instructors can allow students to create discussion groups. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. Discussions can be shared across courses, departments, or any institutional unit. The Q & A forum requires students to post their perspectives before viewing other students' postings. After the initial posting, students can view and respond to others' postings. This feature allows equal initial posting opportunity among all students, thus encouraging original and independent thinking.
File sharing:	Students can submit assignments using drop boxes. Students can upload files to their blog and share them with other users via the blog. Instructors can make complete copies of entire courses and/or individual items in courses, and share them with other instructors.
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. They can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Students can elect to forward their mail to an external address. The Moodle messaging system can deliver mail either online or via email.
Online journal:	Online journal used by millions of people around the world for self-expression and communicating with family and friends. It is usually organized as a chronological series of postings. Online journals usually are written by one person, although some can be authored by groups of people.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site and can search within the glossary words.
Search within courses:	Students can search all course content and search across all courses they are enrolled in with a single search. They also can search courses they are not enrolled in. Search result can display course summaries and can display the text surrounding the searched terms.
Calendar/ Progress Review:	Instructors and students can post events in the online course calendar. They can post announcements to a course announcement page. Students have a personal home page that lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. Students can view their grades on completed assignments, total

	points possible, course grade, and compare their grades against the class performance. They can subscribe to RSS feeds to be notified of changes to materials.
Student profile:	Students can create a personal home page in each course. They have a home page where their blog and personal calendar can be displayed. Custom blocks can be created to show other information
Work offline:	Students can benefit from the materials offered by inst ructors to get the knowledge offline.

C. Instructor Tools (Course Development):	
Online editor for course organization:	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. They can create linear learning sequences organized hierarchically by course, lesson, and topic, can reuse courses as templates for future lessons and assign students to groups. Each group can have its own discussion forum and can have its own chat or whiteboard.
Online quiz editor:	Teachers can define a database of questions for re-use in different quizzes. Questions can be stored in categories for easy access, and these categories can be "published" to make them accessible from any course on the site.
Grade distribution:	Moodle allows a grade distribution tool for each group of students in specific course.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments, set a time limit on a test and permit multiple attempts. The students are allowed to review past attempts of a quiz. Instructors can specify whether correct results are shown as feedback. The system supports Remote Quiz Protocol which allows questions to be rendered and scored externally to the system via standards-based web services. It supports latex rendering of mathematical equations. Test types available in Moodle: Multiple choices, Multiple answer, Matching, Ordering, Jumbled sentence, Calculated, Fill-in the blank, Short answer, and Essay. Questions can contain other media elements (images, videos, audio). Custom question types can be defined. Instructors can create personal test banks and create system wide test banks. The system provides test analysis data. There are a wide range of supported question types for import, and new question importers are easy to write.
Online grading:	Instructors can choose to mark each student on all questions or to mark each question on all students. When an instructor adds an assignment to the course, the software automatically adds it to the grade-book. Instructors can add grades for offline assignments. They can export the scores in the grade-book to an external spreadsheet. They also can create a course grading scale that can employ either percents, letter grades, or pass/fail

	metrics. In addition, they can add detailed comments to manually graded items in the Assignment module, Lesson module, and Quiz module.
Course templates:	The software provides support for template-based course creation. Course content may be uploaded through WebDAV. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course.
Curriculum management:	Instructors can selectively release assignments, assessments, and announcements based on specific start and stop dates. They can personalize access to specific course materials based on group membership.
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course, change the order and name of menu items for a course, and create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look and feel templates as well as institutional images, headers and footers.
Automated glossary:	This activity allows participants to create and maintain a list of definitions, like a dictionary. The entries can be searched or browsed in many different formats. The glossary also allows teachers to export entries from one glossary to another (the main one) within the same course. If glossary auto-linking is enabled by an administrator then it is possible to automatically create links to these entries from throughout the course.

E. Administrator Tools:	
Authentication:	Administrators can allow guest access to all courses. The system can authenticate against an external LDAP server, authenticate using the Kerberos protocol, supports Shibboleth, and supports the Central Authentication Service (CAS). It can authenticate against IMAP, POP3 or secure NNTP. And support multiple organizational units and virtual hosts within a server configuration. Different users can have different authentication settings. The Moodle Network enables different servers to join in trust relationships to provide single sign-on between Moodle sites.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. They can distribute the permissions and roles across multiple institutions or departments hosted in the server environment. Instructors or students may be assigned different roles in different courses.
Validation of input:	It is available for some entries.

Automated registration:	Instructors can add students to their courses manually or allow students to self-register. Administrators can batch add students to the system using a delimited text file, transfer student information bidirectional between the system and an SIS using delimited text files, and transfer student information bidirectional between the system and an SIS using IMS Enterprise Specification v1.1 XML files via web services. The software supports data interchange with student information systems through an event-driven API. ,and supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. The software is compliant with the IMS Enterprise Specific ation for Student Data.
Course creation, duplication, and deletion:	Instructors can create, edit, duplicate, any of their course. The administrator also can do the same.
Course and web site back-up:	Moodle has a course backup and restore process. Each successive version of Moodle has offered more options in this process. The on demand backup and restore functions can be found in the administrative block of a course. An administrator or user with appropriate permissions can use the backup restore functions to create, transfer or restore parts of an existing course or a whole course.
Statistics:	Usage statistics can be aggregated across courses or across the institution.
First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	All major web browsers work fine.
Database required:	The system supports Oracle, MS SQL Server, MySQL, PostGreSQL, The application requires only one database and can coexist with tables from other applications.
UNIX server:	A Unix version is available.
Windows server:	A Windows version is available.
Technical Support	
Help desk:	Students can access context sensitive help for any tool. The system includes online tutorials which can students help students learn how to use the system.
Multi-languages support:	Moodle offers over 70 languages.

Pricing/Licensing	
Company profile:	Moodle.org is an open source community launched in 2001 that has grown out of a PhD research project by Martin Dougiamas. Version 1.0 was released on August 20, 2002. Moodle.com is a company launched in 2003 that sponsors Moodle development and provides commercial support, hosting, custom development, and consulting. The Moodle Partners are a network of companies that work with Moodle.com to provide services around the world.
Cost:	Free
Open source:	The software is distributed under one of the OSI-approved licenses.

Product Name: Moodle
Version: 1.9
Company: Moodle
URL: http://www.moodle.org/
Developer: Moodle.org
Contact Developer: http://moodle.com/helpdesk/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
View course objectives:	It offers a frame to view the course objectives. Instructors can assign the objectives for each course they instruct.
View course activities:	It offers a frame to view the course activities. Instructors can assign the activities that should be done by students for each course they instruct.
Feedback for users:	The Feedback module allows you to create and conduct surveys to collect feedback from Students. It is smaller in scope and therefore easier to use than the Questionnaire module, and unlike the Survey tool allows you to write your own questions, rather than choose from a list of pre-written survey instruments. It is currently an optional module though it may become part of the standard install for version 2.0 of Moodle. Teacher feedback is appended to the assignment page for each student, and notification is mailed out.
Self-assessing for students:	Instructors can create self-assessments for all students in his/her own courses. Students can upload their assignments (any file format) to the server -they are date-stamped. Late assignments are allowed, but the amount of lateness is shown clearly to the teacher. Advanced assignments can allow multiple files to be uploaded. This could keep together preplanning maps, outlines, research papers and presentations. (Not for beginners).
Students' progress tracking and monitoring for teachers:	Instructors can track the frequency and duration of student access to individual course components. Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. Instructors can review the navigation record of each student.

B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The chat tool supports unlimited simultaneous group discussions. Students can create new rooms. The system creates archive logs for all chat rooms. All sessions are logged for later viewing, and these can also be made available to students.
Audio/Video conferencing:	Audio/Video conferencing is available with the chat service.

Whiteboard:	There are several optional add-ons with whiteboard capabilities such as Elluminate and DimDim.
Asynchronous:	
Discussion forums:	Students can enable or disable posts to be sent to their email. Students can receive posts by email as daily digests of subject lines or whole posts. They can subscribe to forum RSS feeds. A spell-checker is available for student and instructor responses. Granular roles system enables students to be set as administrator of individual forums in a course. Instructors can allow students to create discussion groups. Posts may be peer reviewed by other students. Instructors can view statistical summaries of discussions displaying participation which can be used to generate grades. Discussions can be shared across courses, departments, or any institutional unit. The Q&A forum requires students to post their perspectives before viewing other students' postings. After the initial posting, students can view and respond to others' postings. This feature allows equal initial posting opportunity among all students, thus encouraging original and independent thinking. Students from different courses can interact in system-wide chat rooms or discussion forums.
File sharing:	Students can submit assignments using drop boxes. They can upload files to their blog and share them with other users via the blog. Instructors can make complete copies of entire courses and/or individual items in courses, and share them with other instructors or load them into one of the eCMS systems with Moodle integration (Hive, Odalis, etc.).
Internal e-mail:	Students can use the built-in email functionality to email individuals or groups. They can use a searchable address book. Instructors can email the entire class at once at a single address or alias. Students can elect to forward their mail to an external address. The Moodle messaging system can deliver mail either online or via email.
Online journal:	Online journal used by millions of people around the world for self-expression and communicating with family and friends. It is usually organized as a chronological series of postings. Online journals usually are written by one person, although some they can be authored by groups of people.
Search	
Metadata and keyword search engine:	Students can search within the terms and keywords related to courses in the site also can search within the glossary words.
Search within courses:	Students can search all course content. Students can search across all courses they are enrolled in with a single search. They can search courses they are not enrolled in. Search result can display course summaries and can display the text surrounding the searched terms.
Calendar/ Progress Review:	Instructors and students can post events in the online course calendar also can post announcements to a course announcement page. Students have a personal home page that

	lists all courses in which the student is enrolled, new email and all course and system-wide events from their personal calendar. They can view their grades on completed assignments, total points possible, course grade, and compare their grades against the class performance also subscribe to RSS feeds to be notified of changes to materials. The Calendar shall display the following events: Site (event viewable in all courses - created by admin users), Course (event viewable only to course members - created by teachers), Groups (event viewable only by members of a group - created by teachers), and User (personal event a student user can create - viewable only by the user). Events are added to the calendar, and can be aimed at individual users, your defined groups, or your courses. Adding closing dates to assignments, forums, quizzes, etc. will cause them to show up in the calendar block. You can view previous or future months on Calendar by clicking the left/right arrows next to the current month's name. The current date is outlined. You can hide or show various categories of events by clicking on the color key below the calendar. This can make the calendar easier to read (especially if there are many events on the calendar). For example, if you wanted to hide Group event dates (events assigned to learner Groups you create), click "Group events" on the bottom of the Calendar. This would hide all group events, and the color code would disappear from the link on the calendar. To show the events again, click the Group Events link again. Both the daily detail screen and the monthly detail screen have the Preferences button in the upper right. This button leads to a screen like this: The last two settings ('Maximum upcoming events' and 'Upcoming events look-ahead') affect how the Upcoming Events block displays information. You may change any of these settings to suit your class needs. When you have finished any changes, click Save changes. Both the daily and monthly detail screens have the New Event button. This allows you to manually add events for your classes (remember that the system will automatically add due dates for assignments, quizzes, etc. when you create those activities).
Student profile:	Students can create a personal home page in each course. Students have a home page where their blog and personal calendar can be displayed. Custom blocks can be created to show other information.
Work offline:	Students can benefit from the materials offered by instructors to get the knowledge offline. Students don't need to be online all the time. Instructors can make assignments offline by downloading them and then submitting them for instructors by email.

C. Instructor Tools (Course Development):	
Online editor for course	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. They can

organization:	create linear learning sequences organized hierarchically by course, lesson, and topic and can reuse courses as templates for future lessons. Instructors can assign students to groups. Each group can have its own discussion forum and can have its own chat or whiteboard.
Online quiz editor:	Teachers can define a database of questions for re-use in different quizzes. Questions can be stored in categories for easy access, and these categories can be "published" to make them accessible from any course on the site. Quizzes can have a limited time window outside of which they are not available. At the teacher's option, quizzes can be attempted multiple times, and can show feedback and/or correct answers. Quiz questions and quiz answers can be shuffled (randomized) to reduce cheating. Questions allow HTML and images. They can be imported from external text files. Quizzes can be attempted multiple times, if desired. Attempts can be cumulative, if desired, and finished over several sessions. Multiple-choice questions supporting single or multiple answers. Short Answer questions (words or phrases). True-False questions Matching questions. Random questions. Numerical questions (with allowable ranges). Embedded-answer questions (cloze style) with answers within passages of text. Embedded descriptive text and graphics.
Grade distribution:	Moodle allows a grade distribution tool for each group of students in specific course. Instructors can benefit from the useful statistics about the grades and.

D. Course and Curriculum Design:	
Automated testing:	The system can randomize the questions and answers. Instructors can create self-assessments and set a time limit on a test. They can permit multiple attempts. The students are allowed to review past attempts of a quiz. Instructors can specify whether correct results are shown as feedback. The system supports Remote Quiz Protocol which allows questions to be rendered and scored externally to the system via standards-based web services. It supports latex rendering of mathematical equations. Test types allows in Moodle: Multiple choice, Multiple answer, Matching, Ordering, Jumbled sentence, Calculated, Fill-in the blank, Short answer, and Essay, Questions can contain other media elements (images, videos, audio). Custom question types can be defined. Instructors can create personal test banks. They can create system wide test banks. The system provides test analysis data. There are a wide range of supported question types for import, and new question importers are easy to write. Teachers can define a database of questions for re-use in different quizzes. Questions can be stored in categories for easy access, and these categories can be "published" to make them accessible from any course on the site. Quizzes are automatically graded, and can be re-graded if questions are modified. They can have a

	limited time window outside of which they are not available. At the teacher's option, quizzes can be attempted multiple times, and can show feedback and/or correct answers.
Online grading:	Quizzes are automatically graded, and can be re-graded if questions are modified. Instructors can choose to mark each student on all questions or to mark each question on all students. When an instructor adds an assignment to the course, the software automatically adds it to the grade-book. Instructors can add grades for offline assignments. They can export the scores in the grade-book to an external spreadsheet and can create a course grading scale that can employ either percents, letter grades, or pass/fail metrics. Instructors can add detailed comments to manually graded items in the Assignment module, Lesson module, and Quiz module.
Course templates:	The software provides support for template-based course creation. Course content may be uploaded through WebDAV. The system allows administrators to use an existing course or a pre-defined template as a basis for a new course. Instructors can reuse courses as templates for future lessons.
Curriculum management:	Instructors can organize learning objects, course tools, and content into learning sequences that are reusable. Instructors can create linear learning sequences organized hierarchically by course, lesson, and topic. Instructors can reuse courses as templates for future lessons.
Customize look and feel:	The system provides default course look and feel templates. Instructors can change the navigation icons and color schemes for a course. They can change the order and name of menu items for a course. Institutions can create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. The system can support multiple institutions, departments, schools or other organizational units on a single installation where each unit can apply its own look and feel templates as well as institutional images, headers and footers.
Automated glossary:	This activity allows participants to create and maintain a list of definitions, like a dictionary. The entries can be searched or browsed in many different formats. The glossary also allows teachers to export entries from one glossary to another (the main one) within the same course. If glossary auto-linking is enabled by an administrator, then it is possible to automatically create links to these entries from throughout the course. When students contribute to a course in a public place like the glossary, their ideas are given weight and attention and often result in a greater pride or ownership of the assignment. Allows participants to create and maintain a list of definitions, like a dictionary. Student entries can be previewed by instructors before publishing. Entries can be searched or browsed using alphabet, category, date, and author. It can be easily referenced by students. Almost any module of Moodle can be set to hyperlink -automatically- to any word or phrase that is stored in

	or added to the glossary. Glossary items can be grouped in categories. Participants can comment on glossary entries. Entries can be rated using teacher-defined scales. Glossaries can be easily exported and imported via XML. Glossaries can be fully searched. Glossaries can be viewed with different display formats.
E. Administrator Tools:	
Authentication:	Administrators can allow guest access to all courses. The system can authenticate against an external LDAP server and also authenticate using the Kerberos protocol. The system supports Shibboleth, supports the Central Authentication Service (CAS) and it can support multiple organizational units and virtual hosts within a server configuration. Different users can have different authentication settings. The Moodle Network enables different servers to join in trust relationships to provide single sign-on between Moodle sites.
Course Authorization:	The system supports restricting access based on roles and roles can also be customized by the service provider. Administrators can create an unlimited number of custom organizational units and roles with specific access privileges to course content and tools. They can distribute the permissions and roles across multiple institutions or departments hosted in the server environment. Instructors or students may be assigned different roles in different courses.
Validation of input:	It is available for some entries.
Automated registration:	Instructors can add students to their courses manually or allow students to self-register. They can batch add students to the system using a delimited text file and can transfer student information bidirectional between the system and an SIS using delimited text files. They can transfer student information bidirectional between the system and an SIS using IMS Enterprise Specification v1.1 XML files via web services. The software supports data interchange with student information systems through an event-driven API. and supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. The software is compliant with the IMS Enterprise Specification for Student Data.
Course creation, duplication, and deletion:	Instructors can create, edit, duplicate, any one of their course. The administrator also can do the same.
Course and web site back-up:	Moodle has a course backup and restore process. Each successive version has offered more options in this process. Many Moodle site administrators turn on an automated backup function, which does a full course backup on a schedule. The on demand backup and restore functions can be found in the administrative block of a course. An administrator or user with appropriate permissions can use the backup restore functions to

	create, transfer or restore parts of an existing course or a whole course.
Statistics:	Usage of statistics can be aggregated across cou rses or across the institution.
First and last access date for courses:	Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments.

F. Technical Specification:	
Hardware/Software	
Client browser required:	All major web browsers work fine.
Database required:	The system supports Oracle. The system supports MS SQL Server, MySQL, or PostGreSQL. The application requires only one database and can coexist with tables from other applications.
UNIX server:	A Unix version is available – The software is available for most variants of Linux or Unix.
Windows server:	A Windows version is available – The software is available for a variety of Windows web servers.
Technical Support	
Help desk:	Students can access context sensitive help for any tool. The system includes online tutorials which may help students learn how to use the system.
Multi-languages support:	Moodle offers over 70 languages.
Pricing/Licensing	
Company profile:	Moodle.org is an open source community launched in 2001 that has grown out of a PhD research project by Martin Dougiamas. Version 1.0 was released on August 20, 2002. Moodle.com is a company launched in 2003 that sponsors Moodle development and provides commercial support, hosting, custom development, and consulting. The Moodle Partners are a network of companies that work with Moodle.com to provide services around the world.
Cost:	Free
Open source:	The software is distributed under one of the OSI-approved licenses.

Product Name: WebCT
Version: 3.8 CE
Company: WebCT
URL: http://www.webct.com/webct/
Developer: WebCT
Contact Developer: http://www.blackboard.com/communities/ask_drc/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
Self-assessing for students:	The system includes tools, which allow students to view their progression through course readings and activities and current grade information. Instructors, students, and teaching assistants can post course related events and announcements in the course calendar. Students can take practice tests and anonymous surveys integrated with course content and can get instant feedback that does not count toward a grade. Students can use the Mathematics Markup Language equation editor to enter and edit mathematical notations.
Students' progress tracking and monitoring for teachers:	Self-tests are multiple-choice tests created by instructors for students to independently test their knowledge on subject matter, so, each correct answer is provided immediately after answering a question. Also, no grades are recorded and instructors cannot view Self Test results.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The JAVA chat tool includes: one campus wide room and 4 private rooms. The chat displays a list of students in the chat and provides a text box displaying the conversation as it progresses. Students who join late cannot view the prior conversation. The chat is archived and Instructors can view chat logs for student assessment. The Chat tool allows you to have real-time conversations with users of this or all other courses. One general forum for the course and one room for all Oakton WebCT courses. To enter a room, simply click on it. The chat program displays who is in a room at the present time. It also allows you to send private messages to selected users by clicking on their names.
Audio/Video conferencing:	Streaming media can be embedded in content without knowledge of HTML, but the software does not include a streaming server.
Whiteboard:	The WebCT Whiteboard allows for real-time communication among course participants using a graphical paint interface. A user draws on his whiteboard and all other users see what he has drawn. The instructor is given the power to allow the saving and loading of whiteboards.

Asynchronous:	
Discussion forums:	Discussion forums can be viewed by topic, by date, and by thread. Instructors can enable or disable anonymous posting and file attachments. Posts can contain a URL. Instructors may create separate discussion environments for small groups of students and teaching assistants. The system also supports a system-wide chat room where students from different courses can interact. Instructors can create a student lounge within a course shell. The optional Campus Pipeline campus portal product also provides an online community center and allows students to create online clubs and study groups. The Discussions interface is much cleaner, with a table style layout with appropriate headings (Subject, Author, Date, Status, and Attachment). Instructors can set the order of Discussion topics. They can also save topics when resetting a course (e.g., for use in the next term). Designers can now rename, lock or make private the default topics (Main and Notes). However, you cannot delete them. Note: If you make the "Notes" topic private with no members, then students will not be able to make online annotations. The number of messages in a collapsed thread is available, and unread messages are bolded, allowing you to see whether or not there are new messages without having to open the thread. A magnifying glass appears to the left of each thread, allowing you to read the thread without having to use the "View Thread" option from the drop-down (Compile) menu. When sending a reply to a Discussion or e-mail message, the original message will be automatically included. (You no longer have to click the "Quote" button to see the original message.) When you reply to a message, you can change the subject line to more appropriately reflect the content of the message. The Equation Editor is available. All users can create equations in new postings, reply and reply privately. In quote they can create their own equation or edit the original author's equation(s).
File sharing:	Students can submit assignments using drop boxes. They can upload files to a shared group folder. Also they can use the presentation tool to share files and co-edit them in order to publish group projects.
Internal e-mail:	Students can email individual students, instructors or groups. The internal email system supports searching and attachments. Students can elect to forward their mail to an external address. A magnifying glass appears to the left of each message thread, allowing you to read the thread without having to use the "View Thread" option from the drop-down (Compile) menu. Users may rename any folder. Numbers associated with each message: These numbers do not appear in the threaded list. They do appear in the individual messages when you read them. Outbox messages are marked read by default. The Equation Editor is available to all users.

Online journal:	Students can attach notes to any page and can combi ne their notes with the course content to create a printable study guide.
Search	
Metadata and keyword search engine:	Both the glossary keywords and definitions are searched to find a match for the word.
Search within courses:	Students can search all co urse notes, discussion threads, and email subject lines in their course. It allows student and designer to explore a course for specific information within the index, titles, headings, or all text. Click on "Search" to bring up a text-entry field into which a search-word can be typed.
Calendar/ Progress Review:	With the Calendar tool you can view any scheduled events. You can add private entries to the calendar (visible only to yourself) and, if the instructor has allowed it, public ones (visible to everyone in the course). A list of new events pops up when you access the calendar.
Student profile:	Student Homepages allows you to create a personalized Homepage that contains information about yourself, the projects you are working on and links to your favo rite websites. You can click the hyperlinked names of other students in your course to view their Homepage. If the name of a student in the class listing is followed by the word "blank", that student has not created a Homepage. Some of the options you can add to your Student Homepages are: links to your favorite websites, your choice of display colors and layout, background image, banner, header, and footer, and hit counter.
Work offline:	Students can collect and download the entire course content for offline study.

C. Instructor Tools (Course Development):	
Online editor for course organization:	The software includes templates for the construction of various kinds of standard pages including course outlines, assignments and recommended reading lists. In structors can upload documents to the server using drag and drop through WebDAV. and can create bookmarks for specific courses.
Online quiz editor:	The Quiz Module allows the instructor to create and administer on-line tests which can be fully or partly a uto-marked by the computer. Students access the Quiz module by clicking on the Quiz icon which the instructor has placed in the course. An Equation Editor has been added. Designers may enter equations in any question type, but only for the question field. Students only have access to the Equation Editor for Paragraph questions. Designers are now able to randomize the display of answers to Multiple Choice questions, to enhance quizzing security and can tie the release of quiz scores to the expiration of the availability period. They can use text areas for Question, General Feedback, and Answer to reference images in My - Files. TA's are able to preview Quizzes. The performance of the quiz grading mechanism has been enhanced to provide greater system responsiven ess. Designers can now download

	all quiz and survey results in one text file, including paragraph style questions. The student quiz-taking experience has been enhanced. Question status is now tracked graphically to reflect changed answers. Students will be reminded before they submit their quiz which answers they have changed along the way to ensure that they have submitted their final answers to all questions before exiting the quiz. There is a new quiz timer which is dynamically updated, providing students with a much more accurate gauge of their progress through an assessment.
Grade distribution:	The process for adding columns has been streamlined, allowing instructors to more efficiently customize the Grade-book. Instructors can edit assignments grades through the Grade-book as well as the Assignments interface. They are able to manually override the grades for assignments and quizzes not submitted using WebCT (if, for example, the student turned in a late assignment by hand or took a makeup quiz in person).

D. Course and Curriculum Design:	
Automated testing:	The testing tool can create assessments that use the following types of questions: Multiple Choice, Calculated Answer, Matching, and Short Answer/Essay. Questions can be imported from existing test banks or can be both built with the tool. The Mathematics Markup Language equation editor can enable students to enter and edit mathematical notations. The testing tool can support timed test submission and completion, with a range of delivery options, including support for proctored exams. The automated scoring can score multiple choices, matching, calculated and short answers type questions with optional immediate feedback.
Online grading:	Instructors and teaching assistants can mark paragraph questions, and mark assignments turned in through the assignment drop-box online. Instructors can use the grade-book for basic statistical analysis and final grade calculation. The grade book supports the creation of custom columns.
Course templates:	The software provides support for template-based content creation that walks instructors through a step-by-step process to set up the essential features of a course.
Curriculum management:	Instructors can personalize access to specific course materials based on group membership, previous course activity, or student performance. The system can synchronize with course dates defined by the institutional calendar.
Customize look and feel:	The system supports using alternate image libraries to enable branding and customizing the look and feel at both the site level and the course level.
Automated glossary:	This tool presents a glossary of terms and definitions. There may be an icon on the homepage or a link from within the learning material.
Index for courses:	The Index tool lists the index entries. This is similar to an index in a book where keywords are listed along with the page references.

E. Administrator Tools:	
Authentication:	Software supports Secure Sockets Layer protocol (SSL) allowing requests from the following areas to be authenticated via a secure server: user logon, user logon hint, user password changes, administrator interface, and the helpdesk interface. Added security features for online assessment include support for IP subnet masks, proctor passwords, and the selective course section access to individuals based on multiple criteria. Administrators can set password length restrictions and require password changes after the initial logon and after a specified period of time. With the Institution License, the system supports authentication with LDAP or Kerberos repositories out of the box. Administrators can also set up fail through authentication, so if a user fails to authenticate against a primary source (ex. LDAP), the system will try a secondary source (ex. The system's own internal user database).
Course Authorization:	Each user is assigned a role as student, teaching assistant, instructor/designer, or Administrator, with appropriate access to tools, functions and information.
Validation of input:	It is available for some entries.
Automated registration:	The administrator can add students to the system. Once students have been added to the system then instructors can add them to the various courses or allow students to self-register as an option. The software includes optional out-of-the-box integration with SCT Banner and Campus Pipeline or customized integration with other SIS or portal systems.
Course creation, duplication, and deletion:	This feature allows an instructor to easily reset student information in the course, such as student records, bulletin board, mail, calendar and others.
Course and web site back-up:	The WebCT backup utility allows the course instructor/TA to: backup a course on the WebCT server, download the backup to a PC for safe keeping, restore the backup to the WebCT server, and move the course from one server to another

F. Technical Specification:	
Hardware/Software	
Client browser required:	Netscape 4.76 and 6.2.1, 6.2.2, 6.2.3 (PC & Mac). Microsoft IE 5.x & 6.0 (PC). AOL 5.0 (Mac). AOL 7.0 (PC). IE 5.x (Mac OS 9.x) And IE 5.x (Mac OS X 10.1)
UNIX server:	Red Hat Linux for Intel libc6 6.2,7.1, 7.2 and 7.3, and Sun Sparc Solaris 7 and 8
Windows server:	Microsoft Windows 2000 Server SP2 or Windows 2000 Advanced Server. (Note: Because WebCT 3.8 uses a newer version of Perl - v. 5.6.1.- the software cannot be installed alongside versions earlier than 3.7 on the same Windows server).

Technical Support	
Help desk:	The system includes an online student guide.
Instructor's technical support:	Instructors can access the full online context sensitive help, which is also available as a separate manual. Instructors can access the online tutorial to help first-timers and an instructor mailing list.
Student's technical support:	Students have access to online help for the discussion forum and for the internal e-mail as well as small helpful descriptions for the other tools.
Pricing/Licensing	
Company profile:	WebCT began as a project by a University of British Columbia professor Murray Goldberg to provide an online learning tool for his students. It was then shared widely across the internet as a freely available product. In 1999 Universal Learning Technology (ULT) acquired WebCT and the software was released as a commercial package. WebCT is a privately held company backed by a group of investors, which include CMGI@Ventures, JPMorgan Partners, SCT, and Thomson Corporation.
Cost:	The Campus Edition Institution License is based on number of full-time equivalent (FTE) students for the institution. The Campus Edition Focus License is based on a limited number of student seats (normally 3000). Technical support is available via web form, email, or telephone. Technical support is free to two administrators per license and available for an additional fee to instructors or additional administrators. Additional support services with four-hour response time and 7x24 Support options are available at additional cost.
Limitations:	
Number of courses:	The software is priced based on the number of courses.
Number of students:	The software is priced based on the number of students.
Number of instructors:	The software is priced based on the number of instructors.
Number of connections:	The software is priced based on the number of connections.

Product Name:	WebCT
Version:	4.0 CE
Company:	WebCT
URL:	http://www.webct.com/webct/
Developer:	WebCT
Contact Developer:	http://www.blackboard.com/communities/ask_drc/

Feature Name	Description
A. Pedagogical Factor (learner and instructor view):	
Self-assessing for students:	Multiple-choice questions can supplement any page of notes in a content module. If there are any such questions associated with a page, WebCT generates a button on the button bar for that page to make them accessible. Clicking on that button presents the questions. WebCT automatically marks student responses correct or incorrect. An explanation can accompany each answer saying why the chosen answer was correct or incorrect, and perhaps supplying hints or extra information. Self-tests are multiple-choice tests created by instructors for students to independently test their knowledge on subject matter, so, each correct answer is provided immediately after answering a question. Also, no grades are recorded and instructors cannot view Self Test results.
Students' progress tracking and monitoring for teachers:	Student progress tracking pages allows the designer to monitor student progress in the course. Indicators such as date of first and last access, time spent on system, percentage of pages visited, and more is available. An indication of course participation by way of the bulletin board is also available in terms of number of original and follow-up postings, and percentage of articles read. The students can be sorted on any tracking field in order to easily identify students who, for example, have stopped making access to the course, or who are prolific posters to the conferences.
B. Learner Environment:	
Communication	
Synchronous:	
Real-time chat room:	The Chat Tool allows synchronous (real-time) communication among students and their instructor(s). The student's view shows the chat rooms, their names, and a list of course participants in each room. The list of users in each chat area is available. Most of the chat rooms are exclusive to students in that course, but there is also one general chat room that allows communication among students in any course on the same WebCT server. Four of the chat rooms are logged in case the instructor wishes to peruse the exchanges taking place there. This tool provides an interactive interface for students and instructors of a course to come together synchronously, or at

	the same time, to communicate by typing and receiving messages instantly.
Audio/Video conferencing:	Streaming media can be embedded in content without knowledge of HTML, but the software does not include a streaming server.
Whiteboard:	The WebCT Whiteboard allows for real-time communication among course participants using a graphical paint interface. A user draws on his whiteboard and all other users see what he has drawn. The instructor is given the power to allow the saving and loading of whiteboards. Future enhancements include the ability to create multiple whiteboards per course, restrict whiteboards to certain users and make specific functions on the whiteboard usable only by those permitted by the instructor.
Asynchronous:	
Discussion forums:	The discussion tool allows communication among all course participants (instructor, graders and students). WebCT keeps track of which articles are read by each student and, by default, initially presents only unread articles. Messages can be searched for content, sender, date of sending, and other search criteria. Messages can be in plain text or html. Messages can contain file attachments and links to URLs. At the end of a semester messages can be downloaded to a PC text file for archive purposes. This tool allows classmates and instructors to communicate by posting messages for each other to read and respond to. By default, messages are sorted by which "thread" they belong to. Threaded messages are a series of replies to a message of the same subject.
File sharing:	WebDAV is a protocol that allows convenient connectivity between a remote server and a local workstation. WebDAV can now be used with WebCT to provide true "Drag and Drop" file transfer capabilities between your PC and the WebCT server. The My Files folder can be accessed from anywhere through My WebCT or through any course section. Students also have a My Files area where they can store and access files related to their coursework.
Internal e-mail:	WebCT email allows the instructor and students to send private messages to each other within the WebCT environment or to external email accounts. Messages can be searched by sender, content and date of sending. At the end of a semester messages can be compiled into a single file and downloaded to a PC. Working just like email, the Mail tool allows WebCT users to send, receive, reply, and forward mail messages to others in the course. In addition, message drafts can be stored, saved messages can be searched, and customized mail folders can be added.
Online journal:	Students can attach notes to any page. Students can combine their notes with the course content to create a printable study guide.

Search	
Metadata and keyword search engine:	Both the glossary keywords and definitions are searched to find a match for the word.
Search within courses:	Search allows you to conduct a search for text within any course. Searching is limited to course content and tools that you have added to your course. This means, for example, that if you do not add Index, the Index option will not appear in the Search drop-down box. Note: Students can use Search only if you have added it to your course. Search can then be opened on the page on which you place it. It also appears as a hyperlink on every page of your course. For more information on how to add Search, see Add Page or Tool. Searching is limited to course content and tools the instructor has added to the course. Searches must specify which area(s) should be searched for a specific text.
Calendar/ Progress Review:	The WebCT calendar can be used to communicate important course dates and events. Calendar messages can contain links to course files and URLs. The instructor and students can use this tool as a private calendar and as a course calendar. Both of them (if permitted) can make public entries. An instructor/designer can download entries to a text file, modify them and then upload them to the calendar. An instructor can make private message entries ahead of time and then make them public (release them to students) when the time is appropriate. WebCT also has a global calendar tool which enables students and instructors, TAs to look at all their course calendars at one time from their my WebCT page. Calendar entries can be associated with a course identifier and displayed in a Palm Date book. This allows students and instructors to exchange information about class events quickly and effectively. This tool can be viewed by month or by day. Entries can be compiled to view in a list format.
Student profile:	Each student can create a homepage for view by others in the same course. The student is provided with an authoring interface much like that of the course designer's. Students can add images, text and links to their homepage without knowing any html at all. The homepage can be called up from a number of locations, including the homepage listing, e-mail, the conferencing system, student management and student progress tracking. All faculty and teaching assistants are eligible to have a WebCT student account. Faculty and teaching assistants who request a WebCT course site are automatically given a WebCT student account and a WebCT designer account with access to their course site(s). However, if you have a WebCT account, a course instructor can give you access to their course site. Instructors can request additional accounts (for guests, graders, designers) for expanding access to their course site(s).
Work offline:	The CD-ROM tool allows students to quickly access large multimedia content files from a local CDROM. In many

	instances it would not be feasible to deliver these files over the web. If a course requires access to large mul timedia files, it is a good idea to distribute the files on a CDROM rather than putting them on the WebCT server or streaming them. This enables much faster access to content and significantly reduces the disk space demand on the WebCT server. This tool ca n help you create an exciting interactive course. Instructors can distribute a CD at the begriming of the course that includes all the images, charts, PowerPoint presentations, audio and movie files that will be used during a course. This tool is only viewable from the student perspective (you must log on as a student to view and test the CDROM). Cans select multiple assignment submissions, save them as ZIP files, and download them for offline review.

C. Instructor Tools (Course Development):	
Online editor for course organization:	WebCT Campus Edition 4.0 includes new course design wizards, providing step-by-step guides that walk faculty and course designers through the completion of common course tasks, including setting up their course Homepage, Syllab us, Organizer Pages, Content Modules, Discussions, Mail, Calendar and Chat.
Online quiz editor:	Quizzes and surveys can be completely or partially graded by WebCT depending upon the type of questions in the quiz; WebCT is unable to automatically grade par agraph questions. Survey responses are automatically tabulated, and the results are summarized. You can: create quizzes and surveys, control how and when students have access to quizzes and surveys, create a database of quiz or survey questions, select que stions from the question database for inclusion in quizzes or surveys, grade or re-grade student submissions, display and analyze quiz and survey results, and create quiz questions on your own computer and import them into WebCT. The Quiz tool assists instructors in administering quizzes to test student knowledge in a web-based format. This allows for greater test-taking efficiency as well as an easy way to compile scores and determine class statistics. Question types: Multiple choice, Matching, Calculated, Short answer, and Paragraph Grading triggered by the student or instructor.
Grade distribution:	This tool allows students to see grades they have received in the course. Students may see WebCT quiz results, and assignment grades. Access Grade Book with a single click from anywhere in course. Students' first and last names are frozen into place while scrolling through other columns. Access to key statistics for each column in the Grade Book (including average, median, maximum, minimum, and standard deviation). Direct grading area added to the Discussions tool automatically recorded in Grade Book, can see all of one student’s posts, can see rest of thread for particular post, and can review total participation versus the class average.

D. Course and Curriculum Design:	
Automated testing:	The testing tool can create assessments that use the following types of questions: Multiple Choice, Calculated Answer, Matching, and Short Answer/Essay. Questions can be imported from existing test banks or can be both built with the tool. The Mathematics Markup Language equation editor can enable students to enter and edit mathematical notations. The testing tool can support timed test submission and completion, with a range of delivery options, including support for proctored exams. The automated scoring can score multiple choices, matching, calculated and short answers type questions with optional immediate feedback.
Online grading:	Instructors and teaching assistants can mark paragraph questions, and mark assignments turned in through the assignment drop-box online. Instructors can use the grade-book for basic statistical analysis and final grade calculation. The grade book supports the creation of custom columns.
Course templates:	The software provides support for template-based content creation that walks instructors through a step-by-step process to set up the essential features of a course.
Curriculum management:	A WebCT course site is only available to students during the semester in which the course is taught. WebCT course sites are available to instructors for development during the semester prior to delivery and during course delivery semester. After course delivery, archive copies of courses are kept for at least of two years. Every semester new WebCT course sites are created for all WebCT course requests. Any instructor or teaching assistant (with the permission of the instructor) may request a WebCT course site using the WebCT Course Request Form. New course sites are created using the Rensselaer or PDE course template unless the instructor specifically requests that the site be based on an earlier version of the course site. A WebCT course entails: Disk space on the WebCT server for course development and delivery, access to the tools and components of Web-based course delivery contained within the WebCT program, course development support, technical support (instructors and students), membership in a low-volume, Rensselaer WebCT support Listserv, contact from Rensselaer WebCT support regarding the use and renewal of your course site(s) each semester, and non-mandatory participation in a regular evaluation of the effectiveness of this service. This tool allows students to view assignments, submit assignments, retrieve assignments for resubmission, and download files provided by the instructor. New Group Manager to create and manage class groups. Central Group Manager tool for creating groups, setting up private group discussion boards and chat rooms in one step. Students can sign up for their own groups and can allow (or not) students to see who has already signed up in each group.

Customize look and feel:	The system supports using alternate image libraries to enable branding and customizing the look and feel at both the site level and the course level.
Automated glossary:	The course designer can create a searchable glossary of terms; links from the notes to the glossary entries are added automatically by WebCT (under the control of the course designer). Thus, the glossary can be reached by the student in one of two ways - by clicking on a highlighted word in the notes (this displays the glossary entry for that word or term) or clicking on the glossary button in the button bar (this displays of portions of the glossary, and allows arbitrary searches of the glossary). This tool is a reference for students provided by the instructor. It contains definitions and explanations relevant to the reading and study material that the instructor thinks may be useful.
Index for courses:	This tool allows the automatic creation of an index of course content and terms. The course designer can add index entries to point to pages of content. Index entries are ordered alphabetically. Each entry can be annotated by the course designer to indicate some special attribute (for example, an annotation "definition of" might be added to a reference for a term on the page where that term was defined). If the student does not find the term they are looking for in the index, they can enter their own term. The course content can be searched to a selectable depth, with the results shown as a series of links that can be perused.

E. Administrator Tools:	
Authentication:	Software supports Secure Sockets Layer protocol (SSL) allowing requests from the following areas to be authenticated via a secure server: user logon, user logon hint, user password changes, administrator interface, and the helpdesk interface. Added security features for online assessment include support for IP subnet masks, proctor passwords, and the selective course section access to individuals based on multiple criteria. Administrators can set password length restrictions and require password changes after the initial logon and after a specified period of time. With the Institution License, the system supports authentication with LDAP or Kerberos repositories out of the box. Administrators can also set up fail through authentication, so if a user fails to authenticate against a primary source (ex. LDAP), the system will try a secondary source (ex. The system's own internal user data base).
Course Authorization:	Each user is assigned a role as student, teaching assistant, instructor/designer, or Administrator, with appropriate access to tools, functions and information.
Validation of input:	It is available for some entries.
Automated registration:	The administrator can add students to the system. Once students have been added to the system then instructors can add

	them to the various courses or allow students to self-register as an option. The software includes optional out-of-the-box integration with SCT Banner and Campus Pipeline or customized integration with other SIS or portal systems.
Course creation, duplication, and deletion:	This feature allows an instructor to easily reset student information in the course, such as student records, bulletin board, mail, calendar and others.
Course and web site back-up:	The WebCT backup utility allows the course instructor/TA to: backup a course on the WebCT server, download the backup to a PC for safe keeping, restore the backup to the WebCT server, and move the course from one server to another

F. Technical Specification:	
Hardware/Software	
Client browser required:	WebCT Campus Edition 4.0 includes a browser checker that automatically detects whether or not the user's browser is supported by WebCT. If the browser is not supported, users are given the option of downloading a supported browser. The browser checker provides automatic troubleshooting, which enhances the user experience and helps to reduce support call volume on campus. Netscape 4.76 and 6.2.1, 6.2.2, 6.2.3 (PC & Mac). Microsoft IE 5.x & 6.0 (PC). AOL 5.0 (Mac). AOL 7.0 (PC). IE 5.x (Mac OS 9.x) And IE 5.x (Mac OS X 10.1)
UNIX server:	Red Hat Linux for Intel libc6 6.2,7.1, 7.2 and 7.3, and Sun Sparc Solaris 7 and 8
Windows server:	Microsoft Windows 2000 Server SP2 or Windows 2000 Advanced Server. (Note: Because WebCT 3.8 uses a newer version of Perl - v. 5.6.1.- the software cannot be installed alongside versions earlier than 3.7 on the same Windows server).
Technical Support	
Help desk:	The system includes an online student guide.
Instructor's technical support:	Instructors can access the full online context sensitive help, which is also available as a separate manual. Instructors can access the online tutorial to help first-timers and an instructor mailing list.
Student's technical support:	Students have access to online help for the discussion forum and for the internal e-mail as well as small helpful descriptions for the other tools.
Pricing/Licensing	
Company profile:	WebCT began as a project by a University of British Columbia professor Murray Goldberg to provide an online learning tool for his students. It was then shared widely across the internet as a freely available product. In 1999 Universal Learning Technology (ULT) acquired WebCT and the software was released as a commercial package. WebCT is a privately held company backed by a group of investors, which include CMGI@Ventures, JPMorgan Partners, SCT, and Thomson

	Corporation.
Cost:	The Campus Edition Institution License is based on number of full-time equivalent (FTE) students for the institution. The Campus Edition Focus License is based on a limited number of student seats (normally 3000). Technical support is available via web form, email, or telephone. Technical support is free to two administrators per license and available for an additional fee to instructors or additional administrators. Additional support services with four-hour response time and 7x24 Support options are available at additional cost.