A COURSE-CONTENT MANAGEMENT SYSTEM DEVELOPMENT AND ITS USABILITY

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Approval of the Graduate School of (Name of the Graduate School)

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ABSTRACT

A COURSE-CONTENT MANAGEMENT SYSTEM DEVELOPMENT AND ITS USABILITY TEST

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Effectiveness and usefullness among the important factors that affect success of online learning environments. During this study, a course-content management system developed regarding effectivity and usability related concerns. One major aim of this study is to develop effective and usable system.

In this study, a course-content management system designed and developed under the light of previous researches. In the design phase, effective design strategies and characteristics of effective and usable learning systems were explored, and system was designed considering these strategies. Then, development phase applied. After system developed, usability techniques was explored, and heuristic evaluation method was choosed as a usability method to measure usability of the system.

During the study, modified version of a checklist that was prepared considering usability heuristics. Applied checklist contains total 108 questions under 13 heuristics (major usability problem). Heuristic evaluation is an expert review

method. Therefore, this study should have been evaluated by experts. 8 experts enrolled in this study. All experts are either Phd or graduate students at instructional technology departments and they have enrolled in web-based studies. They investigated the usability of the course-content management system according to the usability related criterias on the checklist.

When test results were considered, a course-contentmanagement system developed during this study was found usable. Results of this study may enlighten the way of future studies.

Keywords: course-content management system, online learning, e-learning, web-based instruction, model development, usability test.

ÖZ

BİR DERS-İÇERİK YÖNETİM SİSTEMİ GELİŞTİRİLMESİ VE KULLANILABİLİRLİĞİ

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Etkinlik ve kullanılabilirlik çevrimiçi öğrenme ortamlarının başarılarını etkileyen önemli faktörler arasındadır. Bu çalışmada bir ders-içerik yönetim sistemi modeli etkinlik ve kullanılabilirlik ile ilgili endişeler dikkate alınarak geliştirilmiştir. Bu çalışmanın asıl amacı etkin ve kullanılabilir bir sistem geliştirmektir.

Bu çalışmada önceki çalışmaların ışığı altında bir ders-içerik yönetim sistemi modeli tasarlanmış ve geliştirilmiştir. Tasarım aşamasında, etkin tasarım yöntemleri ve etkin ve kullanıbilir öğrenme sistemi yapıları araştırılmıştır. Bu yapı ve yöntemler dikkate alınarak sistem tasarlanmıştır. Tasarlanan yapı üzerine sistem geliştirilmiştir. Sistem geliştirildikten sonra sistemin kullanılabilirliğini ölçmek için kullanılabilirlik ölçme yöntemleri araştırılmış ve heuristic değerlendirme yöntemi seçilmiştir.

Bu çalışmada, heuristic (buluşsal) değerlendirme yöntemi dikkate alınarak hazırlanmış bir kontrol listesinin uyarlanmış biçimi uygulanmıştır. Uygulanan kontrol listesi 13 ana bölüm altında toplam 108 sorudan oluşmaktadır. Buluşsal değerlendirme bir uzman inceleme yöntemidir. Bu sebeple, bu çalışmada uzmanların değerlendirmelerine yer verilmiştir. Çalışmada toplam 8 uzman yer almıştır. Tüm uzmanlar öğretim teknolojileri alanında doktora veya yüksek lisans öğrencileridir ve web-tabanlı uygulamalarda görev almışlardır. Uzmanlar geliştirilen sistemi verilen

kontrol listesinde yeralan kullanılabilirlikle ilgili ölçütleri dikkate alarak geliştirilen ders-içerik yönetim sistemini incelemişlerdir.

Test sonuçları değerlendirildiğinde, ders-içerik yönetim sistemi modeli kullanılabilir bulunmuştur. Bulgular gelecekte çevrimiçi öğrenme ile ilgili yapılacak çalışmaların yolunu aydınlatacaktır.

Anahtar Kelimeler: ders-içerik yönetim sistemi, çevrimiçi öğrenme, e-öğrenme, web-tabanlı öğrenim, model geliştirme, kullanılabilirlik testi.

To my parents

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TABLE OF CONTENTS

LIST OF TABLES

TABLE

LIST OF FIGURES

FIGURE

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Technological development affects learning habits of humanbeing. The concept and methology of learning changes rapidly with technological development. But, the necessity of learning never changes.

Heinich, Molenda, Russell & Smaldino (1996) defines learning as "... the development of new knowledge, skills, or attitudes as an individual interacts with information, and the environment." (p.8) All the things people do during their daily life can be accepted as part of their learning process. For this reason, learning is sometimes called as lifelong learning.

Changes on individuals' knowledge, skills, or attitudes accepted as learning. But, it does not always occur randomly, sometimes extra activities or facilitator (instructor) needed to learning occur. 'The arrangement of information and environment to facilitate learning' (Heinich, Molenda, Russell & Smaldino ,1996, p.8) accepted as instruction. The term environment mainly used for a place where instruction occurs. But, it is more than this. Media, methods, or equipments to enhance learning can also be accepted as an environment.

To meet their learning needs, people use different methods throughout history. At the earlier phases, they only use face-to-face instruction with the assistance of instructors. With technological development, they want to reach and share their knowledge with other people far away from them. They developed new methods to reach them their aims. "In the early 1700s, mail and correspondence courses supplemented by public lectures in Lyceum halls existed in colonial America

(Willis, 1993) (as cited in Picciano, 2001).” These kind of activities continued and increased throughout history. With technological development media, methods and equipments used for education changed.

Common point of activities that is used to educate the people live in other places is separation of instructors and learners. Instruction is usually occurred at different times and places. A learning that occurs as a result of activities that carried out to educate people far away from them called as distance learning and a learning process called as distance education. Moore & Kearsley (1996) defines distance education as “...planned learning that normally occurs in a different place from special instructional techniques, special methods of communication by electronic and other technology, as well as special organization and administration.” (p.8)

Through the end of 20 th century drastical changes occur on distance education and its terminology. Moore & Kearsley (1996) divided evolution of distance education into three different stages (generations). At early stages (the first stage), distance education occurs as a correspondence study, in which the principal media of communication are printed materials with written essays or other assignments being sent by mail. With the apprearance of open universities in the early 1970s and technological development new generation start to appear. Although open universities mainly used printed materials, they also used broadcast (radio & television) and recorded media (audiotapes). Development in computer technology changed distance education’s perspective. In the 1990s, a new generation of distance education based on computer networks, networks and multimedia, started to emerge.

With the rapid growth of internet through the end of 20 th century, online distance education programs start to appear. These programs appear in different types in educational context. They can be used not only as pure distance learning program, but also in the support of traditional education.

The major advantage of online distance education programs is that they may occur synchronously or asynchronously and lots of information can be transfered at a

short time from one place to another. Using asynchronous instruction, instruction can be delivered easily using the Internet without any time or place limitation. In synchronous instruction, instruction can be delivered to people at the same time, but at different places. Synchronous activities can be in the form of synchronous video or audio conferencing, or online chat sessions. All text materials on the Internet can be accepted as part of asynchronous communication. Asynchronous communications can also be in the form of e-mail, messaging lists, bulletin boards or discussion forums.

1.2 Purpose of the Study

Online learning programs broaden the vision of distance education. With online learning, much more people than earlier can take part in distance education programs. People from anywhere can reach these programs at any time through the Internet.

Solely publishing learning materials on Internet is not effective online learning. Effective online learning requires special instructional and course design techniques, and special methods. This techniques should be harmonized using special organization and administration. Interaction among learners, instructors and content should be supplied. Interactivity can be accepted as the power of online learning environments. In addition to interactivity, easiness of use and supplied support are among the important factors that affects success of online learning environments.

The purpose of this study is to create an effective and usefull course-content management system and measure effectiveness and usefulness of the system by conducting usability test.

1.4 Significance of the Study

Electronic communications and digital communications are transforming working habits and are reshaping personal communication and entertainment. This

transformation has had a tremendous effect on learning needs and opportunities. (Garrison, D.R., & Anderson, T., 2003) With the effect of this transformation, people's expectations from education changed. They want to get education without time and place limitation. For this reason, distance education programs applied. These programs applied in different forms and their forms changed with technological development. With the growth of the Internet, distance education programs start to appear on the Internet.

Internet is a platform for reaching wide around and lots of people. Capabilities of the Internet changed shift of distance education to the web-based platform. Most of the distance education platforms start to seem on the Internet. Multimedia support increased effectiveness of the Internet based distance education programs. And, Internet's support for both asynchronous and sysnchronous communication at the same time strengthen the power of the Internet based programs.

The power of the Internet increased number of educational programs presented through the Internet. Common expectations of these studies is to offer better instruction using new technologies and approaches. During this study a course-content management system will be developed. Difference of this program from previous ones is that it will be developed under the light of researchers' advices. And this study will be developed regarding users' needs. Therefore, this study will be designed and developed as user-centered system. It is aimed to increase interaction among users, decrease response time, create simplified learning environment, and remove impersonality of the learning environment.

Common expectation of this study is to develop usable web-based instructional tool that will decrease usability problems that users will meet when using the system or tool. Project developed during this study is designed as a course-content management system. It contains all the tools that will be needed on the system. It is named as e-learning system (ELS), since e-learning is a new terminology and it covers all technology-based educational activities including web-based instruction.

The system developed under unix-based linux platform and using php programming language. Linux is secure, fast and reliable unix-based operating system. Alhtough it is a scripting language, functionality of php and improvements on php make it a strong, fast and reliable and most preferred programming language for web-based platforms. As a result, reliability and security of linux and php strengthen the power of the system. In addition to these, the system can also run on windows operating systems.

Testing usability of this system will intensify the effectiveness of this study and the system. In this way, common usability problems of the system will be found and they will be removed. Usability testing will be made using heuristic evaluation method that was accepted as an effective method for testing usability of web-sites.

Outcomes of the study will give information about the usefulness of ELS. When test results are considered, system will be improved and will made more useful. In addition, findings of the study will direct future studies. New learning systems can be designed considering major or minor problems that have been measured during the study.

1.4 Definition of Terms

Distance Education: The simplest and basic definition of distance education is that an education that occurs at a place where teacher and students are physically separated. It may occur at the same time (synchronous) or at different times (asynchronous).

Web-based Instruction: It is an instruction that is delivered through the internet or web-pages. It can be in the forms of text, images, audio or video. It can be given synchronously or asynchronously.

Computer Mediated Instruction: It is an instruction that is delivered using computers, computer based tools or software. That mainly occurred in the form of student-content interaction. This instruction may be stated in various names;

computer mediated communication, computer based instruction, computer based training or computer assisted instruction.

E-learning: E-learning covers all instruction delivered through multimedia environments. It can be in the form of web-based instruction or any multimedia product. It covers web-based instruction and computer mediated instruction.

Online Learning: Learning that occurs as a result of online distance education programs can be defined as online learning.

Learning Management System (LMS): Learning management system is a software infrastructure that covers plan, organization and management of online learning platforms.

Course-Content Management System (CCMS): Course-content management system is an e-learning platform that covers plan, design, management and control of the structure and content of the learning environment.

User Interface: “Narrowly defined, the interface comprises the input and output devices and the software that services them; broadly defined, the interface includes everything that shapes users’ experiences with computers, including documentation, training, and human support.” (Backer et al., 1995) (as cited in Mandel, 1997, p.14)

Interaction: Interaction can be accepted as a communication that occur among students, instructors and content.

Asynchronous Interaction (Communication): Asynchronous interaction is a one way interaction that mainly occur between student and content. It may also occur among students or between students and instructors through forums, discussion lists or e-mails. The major characteristics of asynchronous interaction is time and place separation.

Synchronous Interaction (Communication): Synchronous interaction is two way interaction that should be occur at the same time. There is no place limitation, it may occur at different places through online chat session, audio or video conferencing. This interaction mainly occur among students or between students and instructor.

CHAPTER 2

LITERATURE REVIEW

In the literature review chapter, literature related to distance education and its development and its forms mainly presented. This chapter covers the newest tendency of distance education web-based instruction and its forms.

2.1 Distance Education

Distance education commonly and simply defined as an education that occurs in a place where teachers and students are separated by distance and time. (Moore & Kearsley, 1996, Picciano, 2001, Wagner, 1999, Gunawardena & McIsaac, 2003, Heinich, Molenda, Russell & Smaldino, 1999) Willis (1994) defines distance education as “the organizational framework and process of providing instruction at a distance.” (p.88) And Moore & Kearsley (1996) defines distance education as “... planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements.” (p.2)

From both definitions it can be figured out that distance education needs special effort and organization. Moore & Kearsley (1996) defines this organization as levels of distance education. According to Moore & Kearsley (1996) distance education has four main levels: distance learning program, distance learning unit, distance learning institution and distance learning consortia. Distance learning program includes activities that are carried out in a traditional learning environments like universities. The main duty of distance learning unit is distance education, it can be part of any instution whose aim is distance education. There is a simple difference between traditional learning organization and distance learning instution; the aim of

the instution. The aim of distance learning instution is only distance learning. Two or more institutions or units forms distance learning consortia.

Willis (1994) defines distance learning (DL) as “the desired outcome of distance education, i.e, learning at a distance.” (p.88) Distance learning can be in various forms of learning where student and teacher are physically separated. (Picciano, 2001, Moore & Kearsley, 1997, Heinich, Molenda, Russell, James & Smaldino, 1999) Instruction in distance learning can be delivered using processes including correspondence courses, broadcast television, and computer-mediated instruction. (Picciano, 2001)

According to Keegan (1996) (as cited in Picciano, 2001, p.5), five basic requirements for distance learning:

1. The quasi-separation of teacher and learner throughout the period of the learning process.
2. The influence of and educational organization for the planning of courses of study and preparation of materials, and for providing academic and student support services.
3. The use of technology and media – print, video, audio, or computer – to carry the content of the course and to provide mechanisms for interaction.
4. The provision of two-way interaction and communication.
5. The quasi-permanent absence of a learning group so that students are thaught more as individuals than as groups (Keagan, 1996, p.50)

Heinich, Molenda, Russell & Smaldino (1996 & 1999) called Keegan’s requirements except the last one as educational characteristics of distance learning.

2.2 Web-Based Instruction & Web-Based Training

Khan (1997) defines the Web-based Instruction (WBI) as “... a hypermedia-based instructional program that utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment.” (p.6) There is no strict

difference between web-based instruction and web-based training. Horton (2000) explained difference between web-based instruction and web-based training as “Web-based Training is the term that is used most often to describe the use of Web technologies for learning within industry, while the terms Web-based education and Web-based instruction are more common within universites.” (p.2) According to Horton (2000); “Web-based training is the confluence of three social and technical developments: distance learning, computer-conveyed education, and Internet technologies.” (p.2)

In WBT or WBI, all instructional activities occur on the Internet. Learners need to do most of the activities by themselves. Doing these activities require extra effort. To take advantage of this system learners should have some additional characteristics. Horton (2000) defines characteristics of ideal learners for web-based training as follows:

- Learn independently and view learning positively
- Are self-disciplined, manage time well, and enjoy working alone
- Express themselves clearly in writing
- Have a good basic computer skills and value the role of technology in business and learning
- Need to acquire new knowledge now but cannot easily attend traditional training, for example those travel or live in a remote location
- Laugh at small technical glitches and revel in solving problems
- Have a definite goal, such as certification, a degree, or the ability to perform a specific task
- Are moderately experienced in a field and already understand the basic concepts of that field. (p.18-19)

WBT is a new form of distance education. Instructional activities of WBT published on the Internet and learners can reach these activities at anytime and anywhere. There is no time or place restriction. Therefore, it has some advantages to traditional education and other distance education methods. Horton (2000) listed advantages of WBT as:

- Access to Web-based resources
- Centralized storage and maintenance
- Collaboration mechanisms
- Constant availability, non-judgmental testing, instant feedback (common CBT)
- Cost-saving (travel expenses, facilities and supplies, reduced administrative cost and etc.)
- WBT enables better teaching techniques

With WBT (WBI), instructional activities take new forms. These forms bring to new vision to instruction. With the help of technology, WBT changes teaching techniques. Horton (2000) stress this point as "*WBT enables better teaching techniques*" (p.22). Horton listed advantages of WBT on teaching as:

- WBT activates learners
- WBT exposes learners to real-world data
- WBT provides a more in-depth learning experience
- WBT can develop better thinking skills
- WBT lets learners reflect before responding
- WBT promotes collaborative learning
- WBT uses effective learning techniques
- WBT emphasizes learning not but in seats
- WBT helps learners identify knowledge resources

Although WBT has lots of advantages, it has some disadvantages. Horton (2000) listed disadvantages of WBT as:

- WBT requires more work
  - More instructor effort required
  - Conversion efforts take longer than expected
  - More effort required by learners
- Learners fear losing human contact

    - Many claim that distance learning is impersonal
- Technical requirements difficult to meet
- WBT disrupts established ways that work
    - Lectures are not so bad
    - Many learners prefer a traditional format
    - Some professionals may feel threatened by WBT
    - Some fear fast obsolescence
- WBT can distort learning
- Traditional training is viewed as a reward
- Dropout rates may be high

In WBT (WBI) environments, the role of instructors is different from other distance education programs and traditional education. According to Horton (2000) the role of instructor in WBT: “The teachers role in coaching, observing learners, offering hints and remainders, providing feedback, scaffolding and fading, modeling and so on, are powerful enhancements to any learning situation.” (p.54)

2.3 Online Learning

Boettcher (1999) (as cited in Hopper, 2001, p.36), online learning is “an educational philosophy for designing interactive, responsive, and valid information and learning opportunities to be delivered to learners at a time, place, and in appropriate forms convenient to the learners.” Nichols (2000) defines online learning as “an education that occurs only through the Web, that is, it does not consist of any physical learning materials issued to students or actual face to face contact.

Online teaching and learning mean teaching and learning takes place over a computer network of some kind (e.g., an intranet or the Internet) and in which interaction between people is an important form of support for learning process. Online learning includes both asynchronous and synchronous forms of interaction as well as interaction through text, video, audio, and in shared virtual tools. (Goodyear, Salmon, Spector, Steeples, Tickner, 2001).

2.4 E-Learning

Garrison & Anderson (2003) defines e-learning as "... networked, on-line learning that takes place in a formal context and uses a range of multimedia technologies." (p.2) According to Zahner (2002) "E-learning is an extension of the traditional courses, classes or training sessions to the desktop where learning opportunities can be provided in asynchronous, self-paced formats or in synchronous virtual classes." (p.12)

At some places e-learning accepted as synonym of online learning. But the scope of e-learning is much broader than online learning. Govindasamy (2002) defines the scope of e-learning. According to Govindasamy (2002) "E-learning includes instruction delivered via all electronic media including Internet, intranets, extranets, satellite broadcasts, audio/video tape, interactive TV, and CD-ROM." (p.288) Also, Wallhaus (2000) accepts e-learning as synonym of technology-based learning. From these definitions, it can be deduced that e-learning covers all instruction delivered through multimedia environments, not only the instruction delivered through the Internet. But, online learning covers the instruction only sended through the Internet.

Garrison & Anderson (2003) accepts Internet as the major parts of e-learning environments. Garrison & Anderson (2003) explained the importance Internet for e-learning as "E-Learning is an open system with the power of the Internet, the teaching and learning transaction is exposed to unfathomable amounts of information." (p.3)

Though Internet is major e-learning delivery platform, e-learning can also be delivered using other delivery platforms. Driscoll(2002) classified four kinds of e-learning delivery platforms. They can be used alone or combination of more than one.

- *Web/Computer-Based Training (W/CBT).* Individual learning that features drill and practice, simulations, reading, questioning, and answering.

- *Web/Electronic Performance Support Systems (W/EPSS).* Just-in-time training focused on problem solving. This is similar to online job aid.
- *Web/*Virtual *Asynchronous Classrooms (W/VAC).* Non-real-time group learning using experimental tasks, discussions, and team projects.
- *Web/Virtual* Synchronous *Classrooms (W/VSC).* Real-time collaboration using group learning techniques such as discussions, problem solving, and reflection. (Driscoll, 2002)

2.5 Learning Management System

According to Driscoll (2002), “the term learning management system (LMS) embraces just about any use of Web technology to plan, organize, implement, and control aspects of the learning process.” (p.70) Greenberg (2002) defines LMS as “...a high-level, strategic solution for planning, delivering, and managing all learning events within an organization, including online, virtual classroom, and instructor-led courses.” LMS is not a simple tutorial or a web-based tool, “it can be throughout of as the platform in which online courses or online components of courses are assembled and used from.” (Nichols, 2003, p.2) It may contain different e-Learning tools developed for different educational purposes and available through a shared administrative interface. (Nichols,2003)

“An LMS is a software infrastructure that supports delivering, measuring and managing all methods of traditional and eLearning using the Internet (or a corporate intranet) on a largely self-service basis.” (Williams, 2002a). According to Greenberg (2002), management of learners, following their learning progress and performance through all learning activities are focus of learning management systems.

According to Greenberg (2002), some of the capabilities of LMS:

- Support for blended learning. People learn in different ways. An LMS should offer a curriculum that mixes classroom and virtual courses easily.
- Integration with HR (Human Resources).
- Administration tools.

- Content integration.
- Adherence to standards.
- Assessment capabilities.
- Skills management.

"The focus of an LMS is to manage learners, keeping track of their progress and performance across all types of training activities." (Greenberg, 2002)

Avgeriou, Papsalouros, Retalis, & Skordalis (2003) classified the users of LMS into three categories:

- The *learners* that use the system in order to participate through distance (in place and/or time) to the educational process.
- The *instructors*, being the teachers and their assistants that use the system in order to coach, supervise, assist and evaluate students.
- The *adminisrators* of the system, who undertake the support of all the other users of the system and safeguard its proper operational status.

According to McCormack & Jones (1997) (as cited in Avgeriou, Papsalouros, Retalis, & Skordalis, 2003), an LMS offers services for satisfying specific instructional needs and/or automating (partially or fully) instructional events. LMS should support the development and execution of four basic tasks via a simple, friendly and uniform user-interface:

- *Information distribution*, e.g. announcing the tips of the day, calendar, glossary, etc.
- *Management of learning material*, e.g. customization of the user interface to the needs of the instructor, updating the learning material, etc.
- *Offer of multiple communication facilities*, e.g. asynchronous and synchronous communication.
- *Class management*, e.g. online marking of students' assessments, tracking learners' participation, management of learners profiles, etc.

2.6 Learning Content Management System

"Learning Content Management System (LCMS) is "a system that creates, stores, assembles and delivers personalized e-learning content in the form of learning objects." (Greenberg, 2002) "Learning objects are the small units or building blocks of instruction that can be taken as stand-alone units of instruction even when it is not embedded within a larger structure of content." (Govindasamy, 2002, p.292)

LCMS's provide a number of capabilities to enhance courseware development and delivery. LCMS's facilitate capturing important knowledge generated in the course of daily work in almost any original form (e.g. documents, presentations, emails, etc.) and then re-packaging and re-using it in different forms for different purposes. This provides a means for top-performers and Subject Matter Experts to quickly and easily share their expertise across the enterprise without significantly impacting their personal productivity. (Williams, 2002b)

Greenberg (2002) states key components of LCMS as:

- *Learning object repository.* The learning object repository is a central database in which learning content is stored and managed.
- *Automated authoring application.* To create the reusable learning objects that are accesible in the repository. The application automates development by providing authors with templates and storyboarding capabilities
- *Dynamic delivery interface.* It provides user tracking, links to related resources of informations, and multiple assesment types with user feedback.
- *Administrative application.* To manage learner's records, launch e-learning courses from courses catalogs, track and report the progress of learners, and provide other administrative functions.

2.7 Control & Learner Control

"Control was defined as the opportunity and ability to influence the educational transaction, and was intented to develop a more comprehensive view of independence, a core element of distance education." (Gunawardena & McIsaac, 2003, p.361) "In distance or Internet-based learning, the two concepts that have been linked with control are intedependence and learner control." (Hill, Wiley, Nelson, & Han, 2003, p.435)

According to Hill, Wiley, Nelson, & Han (2003), independence relates to the learners impressions of how well they can function on their own. Intepedence is directly related with internal and external locus of control. When a student has an internal locus of control, he/she perceives that success is a result of personal accomplishments and effort. An external locus of control, in contrast, leads the student to feel that she or he is dependent on factors outside of his/her control for success (e.g., fate, luck). Each of these has implications for learning in Internet-based learning concepts. Assisting learners with adjusting their perceptions of control can greatly facilitate increases in completion of Internet-based learning experiences.

According to Reeves (1993) (as cited in Farrell, 2000, p.5), learner control is "... design features of CBI (computer based instruction) that enable learners to choose freely the path, rate, content and nature of feedback in instruction." (p. 40)

Alessi (1991) (as cited in Farrell, 2000, p.8) segments learner control into four levels. Each level increases the amount of control given the learner. The first level, program controls the sequence, content, context, and degree of interactivity, but allows some simple learner control such as forward and backward movement. The second level, adaptive, combines program and learner control. The program adapts to the learner's correct performance by giving over more control. The third level, advisement, gives the learner control with the use of help buttons or advisement from the program. In the fourth level, student, the learner is given the highest degree of control without instruction or feedback.

2.8 Interactivity

According to Nichols (2003), there are two types of interactivity present; indicative and simulative. Indicative interactivity is typified by the use of button rollovers and site navigation. Clicking a button to start an animation or turn the page is indicative interactivity. Simulative interactivity is interactivity that enables students to learn from their own choices in a way that provides some form of feedback. The ability to select between different Web pages is indicative interactivity; the ability to fly a virtual plane in a realistic environment is simulative interactivity.

2.9 Instructional Interaction

According to Garrison & Anderson (2003) interaction is 'a defining feature of formal education'. (p.41) Dewey's definition supports this "For Dewey, Interaction is the defining component of the educational process and occurs when students transform the inert information passed to them from another and construct it into knowledge with personal application and value (Dewey, 1916)." (as cited in Garrison & Anderson, 2003, p.41).

"Both classroom teachers and researchers have stressed the value of interaction within the educational process." (Garrison & Anderson, 2003, p.41). In e-learning environments, importance of interaction increased and how interaction occur changed. Garrison & Anderson (2003) implied this "E-learning technologies have developed to the extend that quality teacher-student activities can be supported either among groups or individually, and in either real time (synchronously) or in delayed time (asynchronously)." (p.43)

"Instructional interactivity exists between and among the instructor, the learner and the content." (Picciano, 2001, p.71) Garrison & Anderson (2003) named interaction occur among student, instructor and content as '*deep and meaningful learning*'. (p.43)

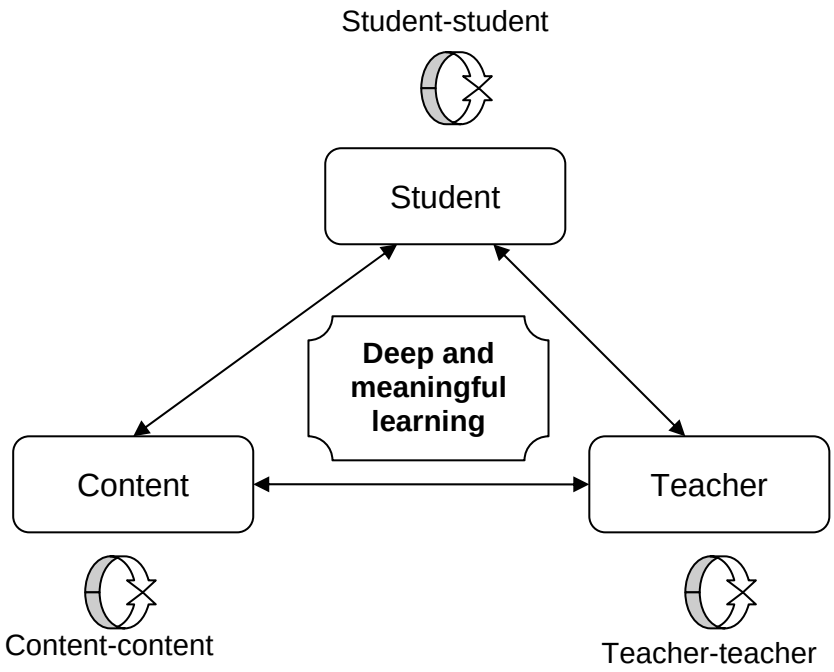

Figure 2.1 Modes of interaction (Garrison & Anderson, 2003, p.43)

2.9.1 Learner-Content Interaction

"It is the interaction the student has with the subject matter that is presented for study. This interaction of student with content is a defining characteristic of education. Education is a process of planned learning assisted by a teacher or teaching institution." (Moore & Kearley, 1996, p.128)

"Learner-content interaction is critical to the learning process, particularly at a distance. Articles, textbook chapters, and web sites are all examples of the kind of materials a learner may need to interact with to extend their understanding in an online course." (Hill, Wiley, Nelson, & Han, 2003, p.435)

2.9.2 Learner-Instructor Interaction

It is an interaction that occurs between instructors and students. "Learner-instructor interaction is a key element that provides dialogue between the learner and

the instructor. This form of interaction enables feedback as well as opportunities to motivate and support the learner.” (Hill, Wiley, Nelson, & Han, 2003, p.435)

According to Heinich, Molenda, Russell & Smaldino (1999), most learning takes when learners are participating actively. Teachers attempt to induce activity in various ways, such as:

- Question-and-answer sessions (carried out during or after the lesson)
- Practice with feedback (carried out as drill-and-practice or discussion activies during the class or as homework)
- Testing

These can also be possible in e-learning environments both synchonously and asynchonously. Synchronous interaction can be possible using online chats and audio or video conferencing. Asynchonous interaction may appear using e-mail, messagesi, discussion list or forums.

2.9.3 Learner-Learner Interaction

“This is an inter-learner interaction, interaction between one learner and other learners, alone or in group settings, with or without the real-time presence of an instructor.” (Moore & Kearley, 1996, p.129) “Learner-learner interaction encompasses the dialogue among and between students in the online course. This dialogue may include the exchange of information or ideas.” (Hill, Wiley, Nelson, & Han, 2003, p.435) “In an e-learning context this interaction is supported through a variety of communications technologies, in both synchronous and asynchronous formats.” (Garrison & Anderson, 2003, p.44)

According to Heinich, Molenda, Russell & Smaldino (1999), for many educational objectives, student interaction with other students, in pairs or small groups, can be extremely effective. Some common ways of structuring student interaction are the following:

- Discussion groups (in or out of class)
- Structured group activities (e.g., role playing or games)
- Group projects
- Peer tutoring

Adding these activities e-learning platforms is also possible. These activities can be added e-learning platforms as discussion forums, chats or other activities.

2.10 Asynchronous and Synchronous Interaction (Communication)

Picciano (2001) defines synchronous communication as communication that occurs at the same time and place. Synchronus communication occurs between student and teacher and student and student. This can be any in the form of classroom discussion, online chat sessions, or audio or video conferencing.

“Synchronous interactions are only possible when instructor and learners are working together in real time. It requires a set of tools that enable learners to see, hear, and/or share applications across the Internet.” (Driscoll, 2002, p.166)

Picciano (2001) defines asynchronous communication as communication that occurs in different places at different times. In asynchronous communication students may access learning materials, e.g. a web page or e-mail, from at home, at work or any other place at any time.

“An asynchronous interaction creates a reciprocal interchange between the learner and the instructional material, instructor, or other learners.” (Driscoll, 2002, p.133)

The major advantage of asynchronous interaction over synchronous interaction is that it supports both immediate and delayed feedback. That is not possible in synchronous interaction. Driscoll (2002) explained this condition as; “Asynchronous interactions may result in both immediate and delayed feedback. Immediate feedback happens when programs automatically score quizzes or link the

learner to documents. Learners may experince delay in learner-to-learner and learner-to-instructor feedback." (p.133)

Asynchronous communication may occur via discussions groups, e-mail messages, or discussion forums. Asynchoronous communication allows users more time to formulate thoughful questions, responses, and comments. (Loughner, Harvey, & Milheim, 1997)

2.11 Class Management

"Class management is all those things that need to be in place to ensure that a class runs smootly, with minimal fuss and maximum satisfaction for all participants." (McCormack & Jones, 1998, p.289)

Class preparation is an important factor for an effective classroom management. According to McCormack & Jones (1998); "A web-based class requires more preparation than a traditional face-to-face class. This preparation is necessary for a number of reasons including reliance on technology, the participants' unfamiliarity with the technology and the lack of administrative support that Web-based teaching methods generally receive compared to traditional teaching methods." (p.290)

According to McCormack & Jones (1998), following pre-class tasks should be done before class starts:

Class promotion. Two reasons to promote a class are to ensure a suitable number of students enroll and to ensure that students who do enroll are fully aware of the class's purpose and requirements.

Time-tabling and scheduling. Timetabling and scheduling ensure that all participants know when, where, and what they are expected to do in order to complete the class.

Enrollments. Storing students' information.

Course advice. Course advice incorporates a range of tasks: recognizing prior learning, checking prerequisites and qualifications, and providing advice.

Preparation of the delivery system. Any mode of teaching involves the use of a delivery system that must be tested and ready to prior to the start of the class. In a Web-based classroom, the delivery system includes the network, Web servers, software, and other resources.

McCormack & Jones (1998) listed classroom management tasks that occur during class session:

Getting to know one another. Learning is a social process requiring interaction with other participants in the class. This process can run more smootly if the participants are familiar with each other.

Information management. A major component of many class management tasks is the retrieval, update, and management of information such as contact information, past academic performance, and current progress.

Group management. A number of group management tasks should be completed.

Adapting to change. Some factors rarely affect class processing. The syllabus or assessment may need to change, and students must receive notification of change.

Student counseling. Student counseling provides the necessary support, advice, and assistance thet helps students complete their studies.

Evaluation. Formative evaluation may be used to discover about certain factors.

Delivery system maintenance. With a Web-based classroom, the educator may be responsible for maintaining the hardware, software, and possibly the network used by the Web-based classroom.

According to McCormack & Jones (1998), after the class some tasks required to do:

Collection, moderation, and distribution of grades. Students' performance will need to be moderated and compared with their performance in other classes to ensure the absence of discrepancies.

Archiving course records and materials. Archive class-related information and records for future reference.

According to Lynch (2002), "online class management refers to those tasks that are usually considered clerical or administrative in the traditional classroom. This would include student enrollments, drops, grading, student tracking, assignment scheduling, and other similar tasks." (p.113)

Existing class management programs include some problems: inflexibility, too much freedom, duplication of data entry and distribution problems. (McCormack & Jones, 1998) Using web-based class management, existing class management tasks can be improved. According McCormack & Jones (1998), this can be done by doing following tasks:

Solve problems with existing approaches. Most of problems associated with current appoaches to class management tasks have to do with difficulty involved in distributing information.

Support the new environment. A Web-based classroom is a new teaching environment and needs the support of a number of new class management tasks.

Enable new practice. As a new environment the Web-based classroom makes it possible to perform old tasks in new ways.

2.11 Research Studies

There are many researches exist related with web-based tools. Many of them uses these tools as support materials to traditional courses. Only a few of them developed as pure web-based instructional problems and few of them aimed to measure usability of these tools. Most of researches at METU (Middle East Technical University) aimed to measure learners' perception about online support tools. And, some of these researches focuses on the success of the tools or systems, not usability or effectiveness of these tools or systems.

Levin, & Levin, Buell, Waddoups (2001, 2002) conducted a research using a project called as CTER Online Program. This project was developed by members of Illinois university. It was a two-year master education project for K-12 teachers and administrators. CTER online courses used a combination of WebBoard® web-based conferencing system (for both sysnchronous and asynchronous text communication), email, group discussions, realplayer(for streaming audio), text translations of audio files. During this study formative evaluation technique used to measure effectiveness and interactivity of online learning environment. Survey data collected during the study. Levin, & Levin, Buell, Waddoups (2001) found that following dimensions of effective online instruction are particularly relevant for providing education opportunities:

1. Relevant and challengeing assignments
2. Coordinated learning environments
3. Adequate and timely feedback: teacher-student interaction
4. Rich environments for student-to-student interaction

5. Fostering flexibility in teaching and learning

Roval (2001) conducted a research study to analyze a five week graduate-level education course taught entirely at a distance via the Internet using the using the Blackboard.com™ e-learning system, with emphasis on exploring the dynamic sense of classroom community. During this study, an observational case study design employing quantitative and qualitative methods was used. Roval (2001) concluded that sense of classroom community among learners increased significantly during the five week course suggesting that on-line instructors can create virtual learning environments that promote a sense of of classroom community. Another conclusion is that interaction and involvement of learners lessened the psychological distance.

Moallem (2003) conducted a research to describe the evaluation results of using an interactive design model for the development of an online course. During the study a course was designed to be delivered over the Internet was entitled "Instructional Systems Design: Theories and Research." It was a three-unit course for a graduate degree in instructional technology. Formative evaluation used course design. Moallem (2003) made some implications:

- Task structure and organization influence the nature and quality of student interaction. A successfull, interactive and collaborative online course requires well-designed and well-developed collaborative tasks or problems, or activities that stimulate peer interaction and encourage peer collaboration.
- Collaborative learning tasks should be carefully designed and developed if they are to promote construction of knowledge through discussion and conversation.
- The nature and type of collaborative tasks influences the content of students' interaction and the concept of shared knowledge construction.

Janicki & Liegle (2001) conducted a study to develop and evaluate a framework for creating web-based learning modules. The system developed was

named as WebTAS (Web-Based Tutoring Authoring System). A protype system was developed and evaluated this prototype conducting surveys. Janicki & Liegle (2001) incorporated five learning principles into the authoring systems: a clear definition of learning, listing of pre-requisite knowledge, providing a variety of presentation styles, enhanced feedback and testing, and permitting the learner to control the pace and direction of learning module. Janicki & Liegle (2001) concluded that learning concepts incorporated into the system do impact learning in a positive manner.

CHAPTER 3

METHOD

During this study a Course-Content Management System (CCMS) has been developed for online learning environments. This CCMS named as E-Learning System (ELS). In this chapter, aims of the system, general structure of the system, design and development processes, evaluation strategies applied during the study are presented.

3.1 Introduction

CCMS can be accepted as a learner-centered application. All activities carried out by users. These users can be instructors, students and administrators. Instructors' main role in the CCMS is guiding students. All learning activities carried out by students. Therefore, learning that occurs as a result of CCMS can be accepted as student-centered learning. Glasgow (1997) (as cited in Brush & Saye, 2000, p.80) defines student-centered learning as a method in which students learn to decide what they need to know to find success within the class and educational format. Athough the teacher may have considerable responsibility in facilitating investigative and discovery activities, it is expected that the student will gradually take responsibility for their own learning.

3.2 Objectives

Main purpose of developing course-content management system during this study is to overcome some usability and implementation problems that other systems have.

According to Flowers (2001), there are some barriers to overcome for effective online learning environments. Some of these barriers are “a lack of perception of need”, “a lack of awareness of online opportunities”, “a perception that online education is too impersonal” and “a perception that online education is inferior quality”. These barriers can be overcomed by improving high quality materials and increasing interaction among users.

Increasing interaction between instructors and students and among students, and inreasing support given to the student and creating easy to use learning environment are among the goals of this project.

Roval (2001), Ingram & Hathorn (2003) and Moallem (2003) accepts interaction as the most important counterpart of online learning environments. Ingram & Hathorn (2003) accepts student’s interaction with the information, with the instructor, and with other students as a part of teaching. And, according to Moore & Kearsley (1996), all kinds of interactions is necessary for distance education. Distance educators should use them. Gunawerdana & McIsaac (2003) emphasizes necessity of interaction between students and instructors. According to Gunawerdana & McIsaac (2003) “the concept of interaction is fundamental to the effectiveness of distance education programs as well as traditional ones.” (p.362)

Another important component of distance learning system is supporting students when they need. According to Holmberg (2000) & Keegan (1993) (cited in Trindade, Carmo, & Bidarra, 2000) Distance learning methodology requires that some kind of support mechanism be available to students, so they can overcome their learning difficulties, get supplementary information, evaluate their own progress and exchange ideas with teachers, tutors and fellow students. Gibson (1998), Levin, & Levin, Buell, Waddoups (2001), Govindasamay (2002), Hill, Wiley, Nelson, & Han (2003), and Gunawardena, & McIsaac (2003) also emphasizes importance of learner support for distance learning programs and online learning environments.

3.3 Research Questions

1. What are the participants' perceptions about course-content management system?

1.1 What are the participants' perceptions about visibility of the system status?

1.2 What are the participants' perceptions about match between system and the real world?

1.3 What are the participants' perceptions about user control and freedom?

1.4 What are the participants' perceptions about consistency and standards?

1.5 What are the participants' perceptions about error prevention?

1.6 What are the participants' perceptions about recognition rather than recall?

1.7 What are the participants' perceptions about flexibility and efficiency of use?

1.8 What are the participants' perceptions about aesthetic and minimalist design?

1.9 What are the participants' perceptions about help users recognize, diagnose, and recover from errors?

1.10 What are the participants' perceptions about help and documentation?

1.11 What are the participants' perceptions about user skills?

1.12 What are the participants' perceptions about pleasurable and respectful interaction with the user?

1.13 What are the participants' perceptions about privacy?

3.4 Design

Design phase of the course-content management composed of three main sub parts: structure, interface design and delivery.

3.4.1 Structure of the CCMS

CCMS developed during this study composed of six main modules. These modules are system, messaging, forum, chat, course and test manager. All modules are related to system modules. Without system module none of the modules can run.

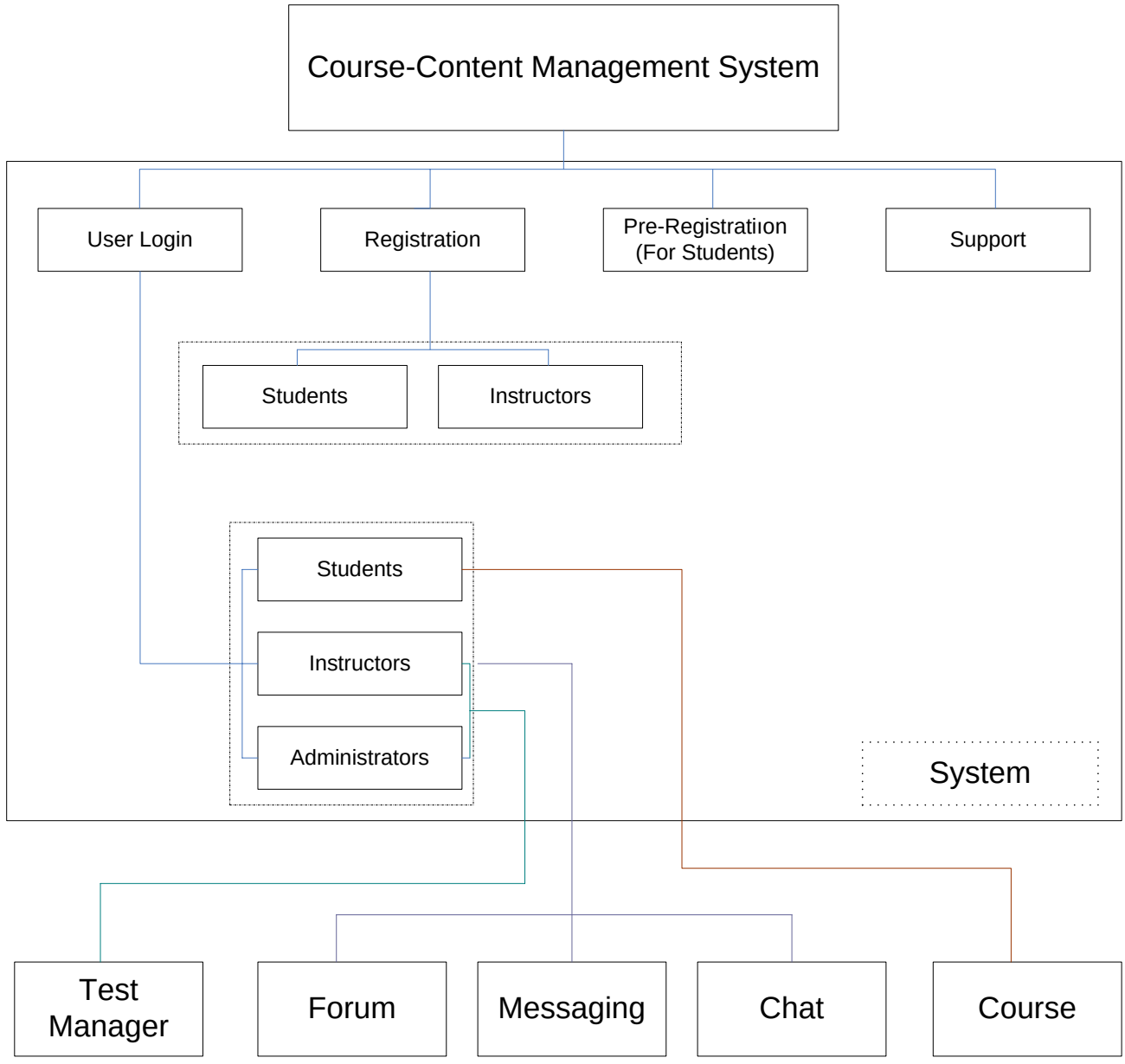

Figure 3.1 CCMS Structure

3.4.1.1 System Module

System module is the main module of this system. All other modules are related to this one. Without system module, none of the modules can run. The parts of this module are different for different users.

Using this module all user-related activities can be done; like registration. This module composed of sub modules for login, registration and management. Management part has different functions for administrators, instructors, and students.

Login: This part contains information about the system. Users can login to system or registration part through this part. New students can register to system using this part. Visitors of the system can send messages to administrator using support form on this part.

Registration: This part is for both students and instructors. There is nothing for administrators. All course registration activities can be done through this part. Students can see all courses, and their previous courses and grades on this part. Students can send messages to system administrators regarding their registration using support form on this page.

This part is also available for instructors. Instructors approve or disapprove students' application to their courses, or they can finalize students' course status. They can see their courses and students registered to their courses.

Administration

Administrator: This part is prepared for system administrators. Registration, user management, course management, forum management, test management, messaging, announcements and user support are the main functions of this part.

Instructor: This part is prepared for instructors. Instructors can manage their courses and course related activities using this part.

Student: This part is prepared for students. Students follow their courses and course related and system activities using this part.

3.4.1.2 Messaging Module

Messaging module is available for all users. Main purpose of this module is to increase interaction among students and instructors. Using this module all users can send or take messages from each other.

3.4.1.3 Forum Module

Forums are discussions environments. Users can send messages under any category or subject. Forums are asynchronous discussion environments.

3.4.1.4 Chat Module

Chat pages are also discussion environments. Users can discuss anything under any category created before. Chats are synchronous discussion environments. All messages can be seen users of the chat rooms (categories).

3.4.1.5 Course Module

Lectures of CCMS are published through this module. This module includes activities regarding lecture session and content.

3.4.1.6 Test Manager Module

This module is for evaluation part of system. Administrators and instructors can prepare tests and quizzes using this part.

3.4.2 User Interface Design

Navigation and screen design are two important factors of user interface design. They affect appealing and usefulness of web sites. “Without consistent screen designs and navigation, learners easily become lost, confused, and frasturated.” (Hannum, 1997, p.161)

According to Graham, Cagiltay, Craner, Lim, & Duffy (2000) navigation should be easy to use and consistent through web-site. “Navigating hypertext can place heavy mental loads on users. In order to orient users and minimize the disruptive effects of jumping from one place to another, visual support and context should be supplied.” (Graham, Cagiltay, Craner, Lim, & Duffy, 2000, p.13)

Standard navigational bars, icons, and links should appear in a consistent location on each page. Navigation icons should be consistent and location of navigational bars or buttons should appear in a consistent spot on each page for ease of use. It is generally a good idea for pages to have a link back to the homepage or the main menu page. The look and feel of navigational icons should be consistent. *Consistent navigation design improves the usability and learnability of the site’s navigation.* (Graham, Cagiltay, Craner, Lim, & Duffy, 2000, p.14)

Menu design and structure of pages, passing from one page to another, guideleness and buttons on the pages can be evaluated under navigation.

Main menu types of the CCMS is tree menu. Since, tree-structured menu systems are usefull for presenting large collections of data. (Shneiderman, 1998) Tree menus used in the CCMS can be both as horizontal drop-down navigation menus or hierarachical tree menus.

Icons and buttons can be used for specific tasks or navigation. They can be online image or they can include text. According to Shineiderman (1998), during icon design icon-pecific guideness should considered. Some of these guideleness as follows:

- Represent the object ot action in a familiar and recognizable manner.
- Limit the number of different icons.
- Consider three-dimensional icons; they are eye catching, but also can be distracting.
- Ensure that a single selected icon is clearly visible when surrounded by unselected icons.
- Make each icon distinctive from every other icon.
- Ensure the harmoniousness of each icon as a member of a family of icons.

Screen design is another important element. “The design of individual screens must follow a general pattern. It is neither esthetically pleasant nor helpful for each screen to have different fonts, different backgrounds, different color combination, and different layouts.” (Hannum, 1997, p.161) According to Hannum (1997), screen design standards should be specified before developing documents. These standards identify the overall layout of screens; the choice, color, and sizes of fonts; the background image or color; and the navigation scheme.

CCMS developed has six different modules. Six different designs will be available for them. Main menu type for used with these designs tree style menus, since they should present large amount of data.

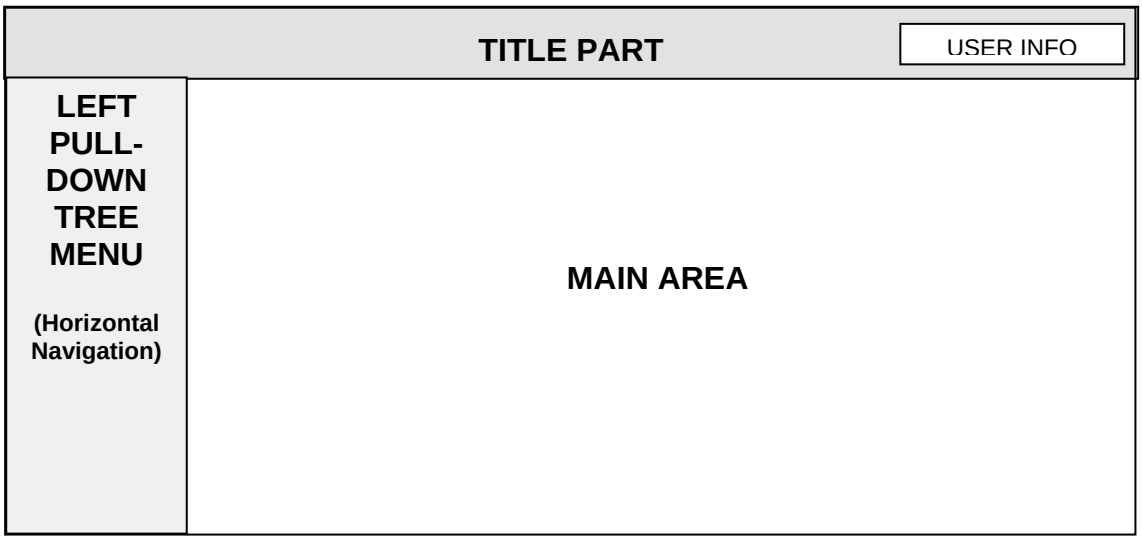

Figure 3.2 System Module Design

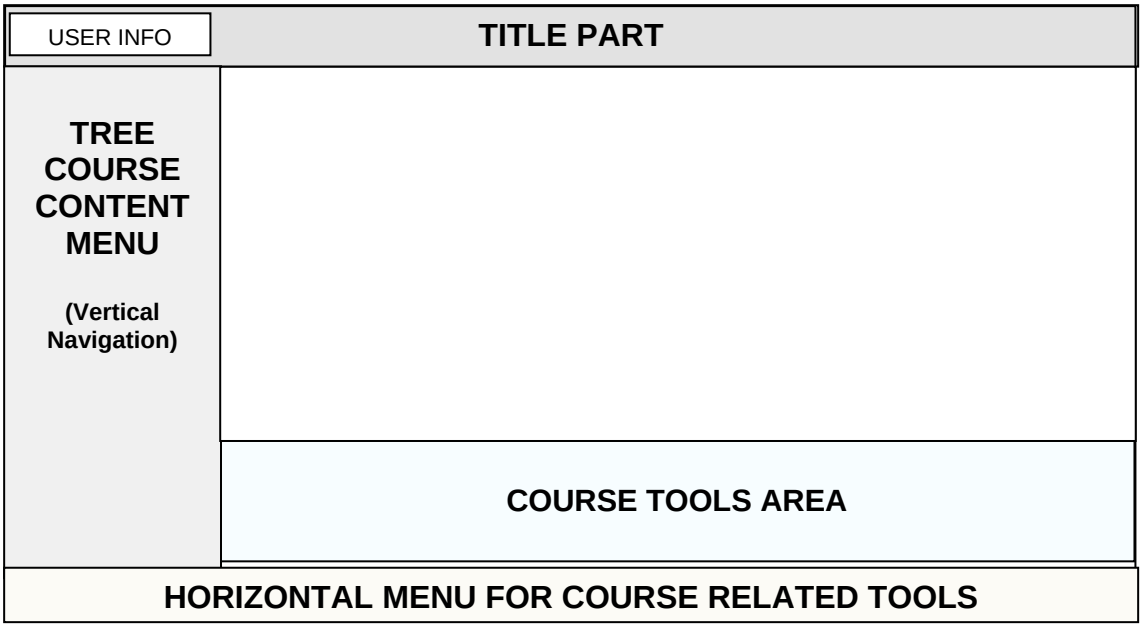

Figure 3.3 Course Module Design

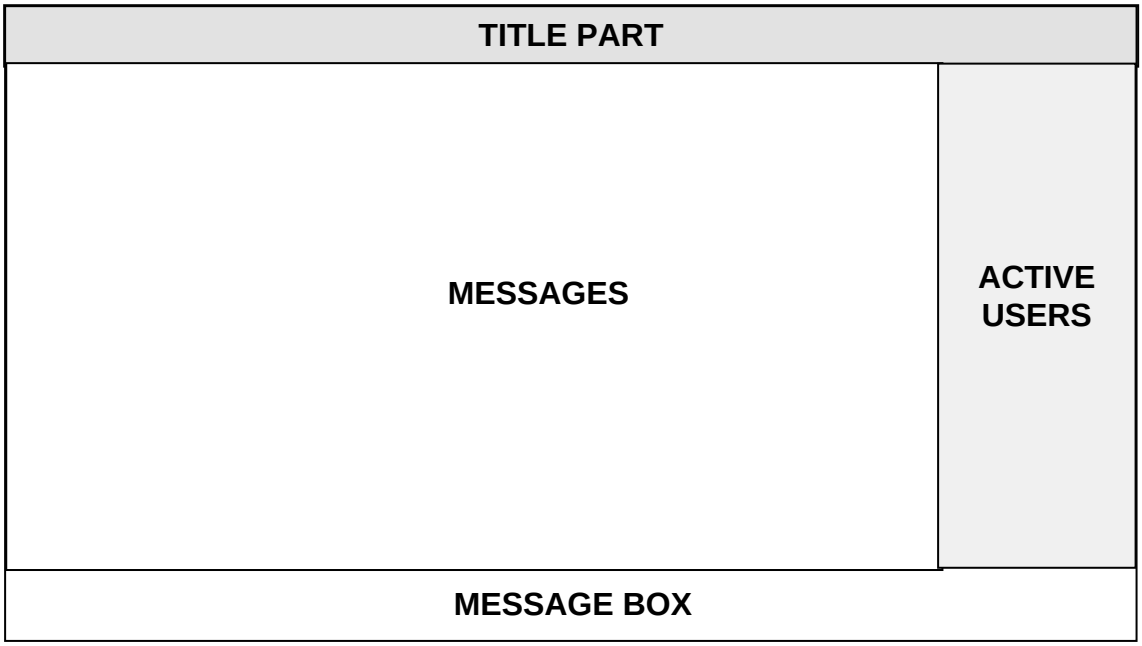

Figure 3.4 Chat Module Design

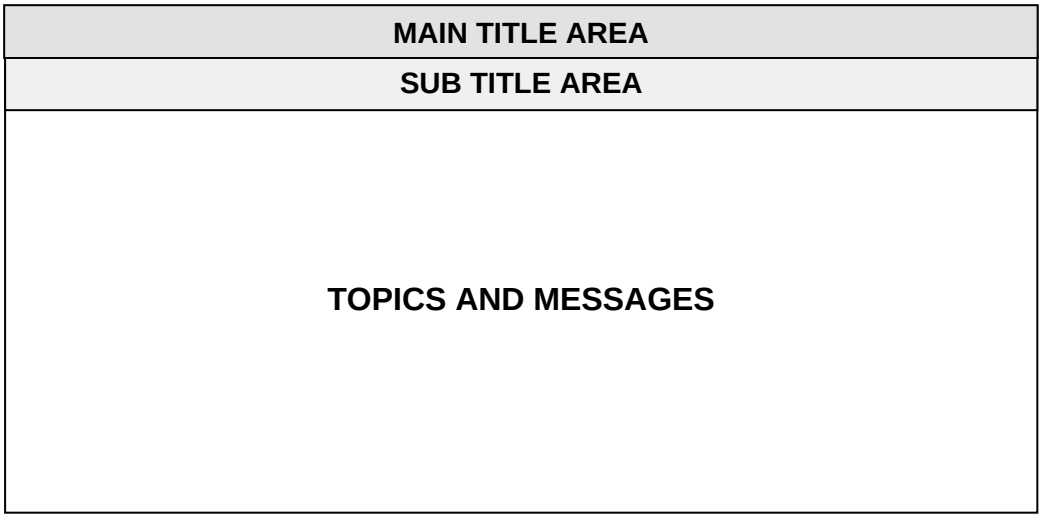

Figure 3.5 Forum Module Design

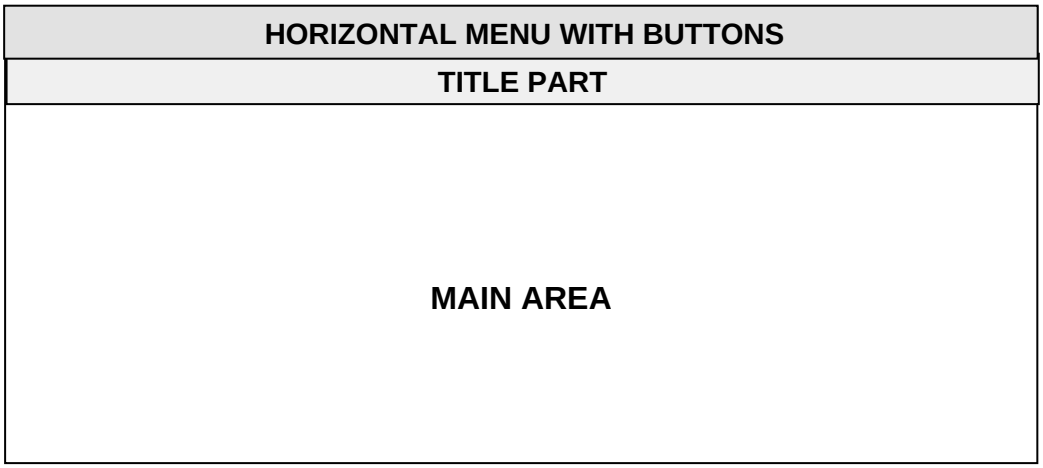

Figure 3.6 Messaging Module Design

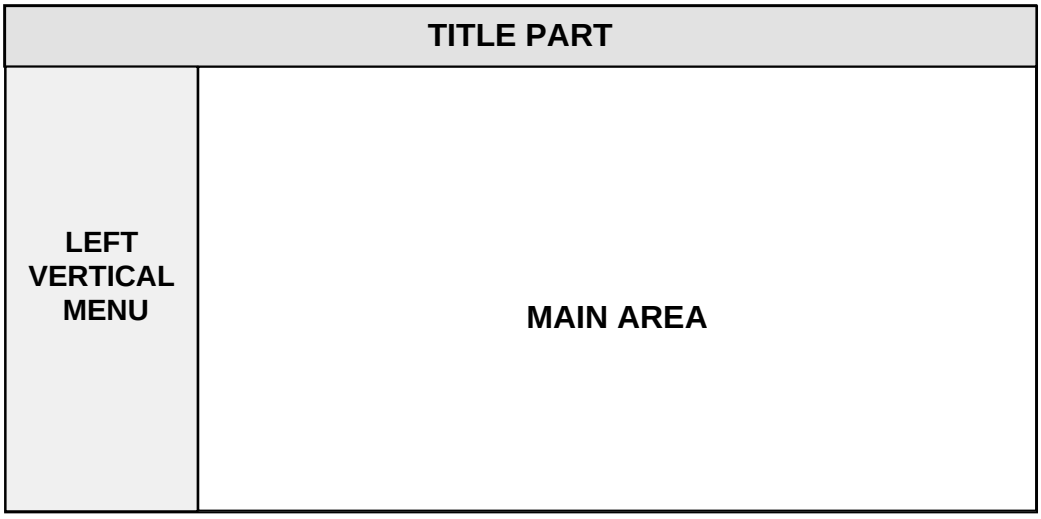

Figure 3.7 Test Manager Module Design

3.4.3 Delivery System

CCMSs are delivered through the Internet. Therefore, the major platform of CCMS is the Internet.

According to Williams (2002b), Online Learning Delivery Systems are always included as an integrated part of the Learning Management Systems. Online Learning Delivery Systems are essentially courseware “players” that deliver (or “launch”) e-Learning courseware over the Internet. The courseware may reside on an in-house server or on the publisher’s server. Online Learning Delivery Systems, allows students to take courses at their own pace any time and anywhere they have Internet access.

Delivery system mainly accepted as web-server for online platforms. Therefore, web-server’s operating system and software that is used can be accepted as delivery platform. During this study, Linux has been choosen as an delivery system. Linux is an operating system based on UNIX.

According to McCarty (2003), Linux is distinguished from other popular operating systems in three important ways:

Linux is a cross-platform operating system that runs on many computer models. Only Unix, an ancestor of Linux, rivals Linux in this respect.

Linux is free, in two senses. First, as mentioned earlier, you can obtain and use Linux without paying anything to anybody. On the other hand, you may choose to purchase Linux from a vendor who bundles Linux with special documentation or applications or who provides technical support.

Second, and more important, Linux and many Linux applications are distributed in source form. This makes it possible for you and others to modify or improve them.

Linux has more attractive features and performance. Free access to Linux source code lets programmers around the world implement new features and tweak Linux to improve its performance and reliability. The best of these features and tweaks are incorporated in the Linux kernel or made available as kernel patches or applications.

Garrels (2003) listed advantages of Linux operating systems as:

- *Linux is free.* The license commonly used is the GNU Public License (GPL). The license says that anybody who may want to do so, has the right to change Linux and eventually to redistribute a changed version, on the one condition that the code is still available after redistribution.
- *Linux is portable to any hardware platform.* Linux can be used any kind of hardware platform, e.g. cars.
- *Linux was made to keep on running.* Linux system expects to run without rebooting all the time.
- *Linux is secure and versatile.* The security model used in Linux is based on the UNIX idea of security, which is known to be robust and of proven quality.
- *Linux is scalable.* Linux can run on all kind of system. Only major components required to Linux to run.

- *The Linux OS and Linux applications have very short debug−times.* Linux has been developed and tested by thousands of people, both errors and people to fix them are found very quickly.

Garrels (2003) listed disadvantages of Linux operating systems as:

- *There are far too many different distributions.* But, all releases contain more or less the same set of basic packages.
- *Linux is not very user friendly and confusing for beginners.*
- *Is an Open Source product trustworthy?* It is a project that is never finished, that is true, but in an ever changing environment, Linux is also a project that continues to strive for perfection.

Linux has different distributions, for example, Slackware, Red Hat and Suse. We choose Red Hat Linux, since it is the most common and widely used Linux distribution.

PHP is a programming language that has been used during the development of system. It is a server-side scripting language mainly developed for Unix based systems. It was developed using C programming language. All php codes run on web-server, therefore users can only see the output of the code.

PHP is officially known as PHP:Personal Home Pages. It is a server-side scripting language often written in an HTML context. Unlike an ordinary HTML page, a PHP script is not sent directly to a client by the server; instead, it is parsed by the PHP engine. HTML elements in the script are left alone, but PHP code is interpreted and executed. PHP code in a script can query databases, create images, read and write files, talk to remote servers—the possibilities are endless. The output from PHP code is combined with the HTML in the script and the result sent to the user. (Zandstra, 2003)

Atkinson (2001) stated advantages of PHP as: “PHP is modifiable. PHP has been designed to allow for future extension of functionality. PHP is coded in C and

provides a well-defined Application Programming Interface (API). Capable programmers may add new functionality easily.” (p.7)

Zandstra (2003) listed advantages of PHP as follows:

- *Speed of development.* PHP allows separation of HTML code from scripted elements, this will couse a significant decrease in development time on many projects.
- *PHP is open source.*
- *Performance.* Because of the powerful Zend engine, PHP shows solid performance compared with other server scripting languages
- *Portability.* PHP is designed to run on many operating systems and to cooperate with many servers and databases. It can run both Unix and Windows environments without a problem. Projects can be tested with Personal Web Server and install it on a Unix system running on PHP as an Apache module.

3.5 Model Development

During the study, a CCMS has been developed for unix based platforms using php programming language. PHP is accepted as an effective programming language for developing online tools for unix based platforms. Also, it can run with other operating systems. In addition to php, mysql is selected as a database of the system. It is easy to use and effective database for unix based platforms. One of unix platforms linux used during this study. Red hat linux operating system selected among linux distributions. Since, it is widely used and most common linux distribution.

CCMS developed composed of six main modules and their sub modules. System module is the main module of the CCMS. All other modules integrated to or connected with system module. Chat, Forum, Test Manager and Course modules are developed as different modules. Their functions, rules, structures and designs are different from system module. These modules connected with system modules using

controllers. Without system modules, they cannot run. Only the messaging module integrated to system module. That means, it works as a part of the system module. Although it is integrated to system module, its functions are independent from system module.

3.5.1 System Module

System module has been developed as main module of the CCMS. All other modules cannot run without system module. Other modules take all user related information from system module.

System module has sub modules and they have different functions for different users. These sub modules can be grouped as login, registration and management (or control).

3.5.1.1 Login

This part is at the center of the CCMS. Users can pass other CCMS modules through this part. Registered CCMS users can login management modules using login form on the login part. All users can login using their username and password, since they have different usernames. Registered students and instructors can login course registration area using registration login form. This part is not designed for administrators, there is no role for administrators during course registration.

Although administrators are responsible for user registration, students can complete their registration process by themselves, this is preferred method. Students can register to CCMS using pre-registration area. This part has two sub parts. First part is for students pre-registration, this is required to prevent student registration with anonymous or invalid e-mail adresses. Using pre-registration form students can get their pre-registration code to reach their registration form. They can login pre-registration area, second part of the registration, using their e-mails and usercodes. They should fill registration form regarding themselves. After submitting form, their pre-registration process is completed. After administrator’s approval, students will get

an e-mail regarding their CCMS account. Using their usernames and passwords, they can login and use CCMS. Besides, before administrator's approval, students can change their information.

Support is an important part of login. Any user who accessed CCMS pages, they can use support form to get help about CCMS. These forms will be evaluated by administrators. Replies regarding messages will be sended to visitors' e-mail address entered to the form.

Support forms in the system module is designed mainly for getting technical support. Therefore, these forms sended to administrators and evaluated by them. According to Gibson (1998) "technical support is critical for distance learner." (p.547) Using support forms on each part is aimed to remove unwanted impacts of giving lack of or delayed support given to the students.

In addition to these, login includes parts that are including information about CCMS and its usage, and contact information.

3.5.1.2 Registration

This part is for instructors and students. The main function of this part course registration.

Students

Students can see all courses, their courses and the courses they have finished before using courses part. They can register any courses that they have not registered before using register button. They can also unregister from not-approved courses. Not aprroved courses are the courses that students registered before but their registration has not been approved by instructors yet.

They can use support forms for any problems they met during course registration. When their forms are evaluated, they will get e-mail to their registered e-mail address from administrators about their forms.

This part also has some parts including information about course registration process.

Instructors

Instructors can follow their classes and student registration to their courses using this part. They can also see other classes and courses on the system. They can follow student registration and their students to his/her classes. They can approve or remove approval of students' course registration. They can also see their previous courses and students' grades. They can also enter course grades for finished courses using this part.

3.5.1.3 Management

This part is the main part of the CCMS. All user related activities carried on this part. Connection to other CCMS modules make on this part. This part prepared for three different types of user with different functions.

3.5.1.3.1 Administrator

Administrators mainly responsible for system management, and user and course registrations. Administrators can do all user registration activities; they may register new users, change user informations and remove or disable user accounts. Another registration activity for administrators is course and class registration. Course and class are two different terms in this CCMS. Course can be any lecture. But, it does not have any function without classes. Classes are formed with assignment of any instructor to any courses. Classes includes extra information to be used during registration process, like section id and capacity. Class information is used through students' course registration. Students can register classes, not courses.

Besides registration activities, administrators are also responsible for general announcements regarding CCMS. These announcements includes information about general and specific activities carried regarding CCMS.

Also, evaluation of messages coming from support forms in the login and student registration part is among the responsibilities of administrators. After evalation of the form, administrators can reply or ignore these forms.

Through management part administrators can enter other CCMS modules. They can prepare tests using test manager, and they can send messages to forums and chats using this modules, and they can send and get messages from all CCMS users using messaging module.

3.5.1.3.2 Instructor

Instructors' can do all course related activities through this part. They can see all courses and their courses and students registered these courses. They can add or edit course related announcements using announcements part. They can also see general announcements added by administrators. They can reply questions coming from students through course module. This is an another activity for student support. Another activity related courses is assigning test to courses, instructors can assign any previously prepared tested as quiz or exams. Tests can be prepared using test manager module.

In addition to course specific activities, instructors can take part in forums or chats. Forums and chats are two important activities for courses, using chats students and instructors can communicate synchronously and using froms they can communicate asynchronously. In addition to forums and chats, they can send and get messages from any CCMS users through messaging module. Another module that instructors can use is test manager, instructors can prepare course specific tests or exams using test manager part.

3.5.1.3.3 Student

Students are in the center of the CCMS. All activities prepared mainly for them. Their main duty is to follow courses and activities regarding courses that they have registered. Students can enter courses, forums and chats using this part. They can see their system activity using activity summary part. They can send and get messages from other students and their instructors by using messaging module. They can see general announcements using announcements part. But, course-related announcements published only in the course module.

Students can use support forms for any problems they met or anything they want regarding system. Besides these, they can change their user information using profile part and they can get help regarding system module using help part.

3.5.2 Messaging Module

This module is prepared for increasing interaction among CCMS users. Interaction between instructors and students, and among students is an important component of online learning activities. Using this module, CCMS users can send messages to all other users. These messages will be sended through CCMS. Users do not need to use any other messaging program or e-mail service to send messages to other users.

This module can be accepted as internal e-mail service of the CCMS. By using CCMS messaging module, users can send message to each other without using any other mail services. According to Driscoll (2002), “e-mail integrated means that learners can send e-mail while in the middle of a lesson; this means that learner can remain focused because he or she does not have to log out of the Web-based training program and log in to send a message.” Although its structure is similar to e-mail, messaging in CCMS is different from any e-mail service. CCMS users can only send message to other CCMS users, not anyone else. Driscoll (2002) states that “e-mail is an excellent way for the intructor and learner to communicate.”

Messaging module is integrated to system module, but it works indepedently from it. Messages in this module saved in three different message boxes; inbox, outbox and archive. Inbox contains messaging coming from other users. Outbox contains messages sended to other users. Archive folder includes users' previously saved messages. Users can save messages coming from other users. Users can follow status of their messages (read or unread) using any message boxes.

Users can create their contact lists using contact list part. By the way, they can store detailed information about users in their contact list. Using message compose form they can send messages to all other CCMS users. They should only need to know username of the user to whom they want to send message. All messages sended using CCMS username of the users. Users can also reach their contact lists easily and get usernames from there.

3.5.3 Forum Module

Forums are asynchronous messaging environments. Horton (2000) accepts forums as a useful discussion groups and defines discussion groups as ongoing electronic converstations among a group of people. One person posts a question or an opinion. Others read it and replies it. Then still others add comments on the replies. The sequence of commentary can go on indefinetely.

Horton (2000) lists advantages of using discussion groups as follows:

- To provide access to immediate information in a rapidly changing field.
- To let users ask questions of experts and others like them.
- To provide a source to answer question beyond the scope of the course.
- To expose learners to practitioners in a field they are studying.
- To have learners conduct research by "interviewing" other on the group.
- To let learners interact with each other without time limitations.
- To let learners answer each other's questions.
- To continue discussions as long as necessary.

In CCMS forums, users can send messages to the forum, to discuss anything with other users of the forum. In forums messages are grouped by their titles and categories. Users can reach messages following these titles and categories. All users can enter forums, but they can only reach allowed forums.

Users can see detailed information about message senders and they can send private message or e-mail to these users. Private messages work as a part of the messaging module. All messages sended using messaging forms in the forum should be followed by messaging module.

Users can edit or delete any of their messages. But, if their message is the first message of the topic, this message also accepted as topic message. So long as it is not answered, users can delete topics and topic messages.

Messages mainly in reach text format except messages sended through quick reply form. Quick reply form is a simple messaging form, users can reply topics easily and fastly using quick reply form.

3.5.3.1 Forum Management

Forum management is an activity designed for controlling forums' usage and keeping forums' run without any problem. It is the responsibility of administrators. Administrators can do all forum management activities using this part. They can create new forum categories or forums, they can create new groups and add users these groups. They can control forum user groups and their authorities. In other words, they can assign any user group as a user of any forum.

3.5.4 Chat Module

Chats are synchronous messaging environments. Users can discuss anything at a certain place with other user present there. These places mainly called as chat rooms. Chats require login of the users to the same room at the same time.

Using chats users can discuss at the same time with other users. They can see other users messages simultaneously.

Horton (2002) lists some of the common uses of chat for instructional purpose as follows:

- Real-time question and answer sessions.
- Brainstorming, troubleshooting, and problem-solving sessions.
- Instructor holding “office hours” during which learners can ask questions.
- “Oral” examinations in a training course.
- Interviews of experts by learners or researchers.

Lynch (2002) and Levin, Waddoups, Levin & Buell (2001) stress the necessity of online office hours. Levin, Waddoups, Levin & Buell (2001) accepts online office hours as an important part of support mechanism. According to Levin, Waddoups, Levin & Buell (2001); “conducting online office hours is one way in which student-teacher interactivity can be accomplished.” According to Lynch (2002), online office hours should be counterpart of traditional office hours. Online office hours should made at an arranged times. For online learning environments, office hours can be made using chat sessions.

According to Horton (2000), chat should never be used for lectures. Since, it is scrolling messaging area and reading scrolling messages is awfull method. Another problem is that there is no control on messages, interuptions may occur frequently.

Horton (2000) lists two most important advantages of using chats as:

- Chat provides nearly immediate feedback. For complex questions that require follow-up and clarification, a chat session can accomplish in minutes what would take days with e-mail or a discussion group.

- Chat leaves a written transcript. Some students want to see the content off chat session. In the CCMS developed, future reading is supplied with chat logs.

The chat module in the CCMS is a simplified synchronous messaging system. Users can discuss anything under any chat category. Messages sended simultaneously, therefore any user want to follow chat session must enter this chat room. However, users can see chat content in the future by accessing taken chat logs.

The chat of the CCMS has more capabilities than sending text messages. Users can use emoticons in their messages to show their feelings. By the way, chats' appealing may be increased. According to Broadbent & Legassie (2003), non-verbal clues (emoticons) are very important for encouraging students to engage with the instructor and other students. Users can also send messages to specific users using specified characters. Horton (2000) mention this as "use private chat to ask a question or make a comment without interrupting the whole class. Or to remain anonymous from the rest of the class."

In addition to these, chat module has some administrative capabilities. Instructors or administrators can warn users or dismiss users. Using warning, instructors or administrators can warn users who disturb other users. Warning messages can be in two types with punishment or without punishment. Punishment of warning can be preventing users to send message for a limited time. During this time, punished user cannot send messages, but they can see other users' messages. Another punishment type dismiss (sending users away) has more strict results. Users who get dismiss punishment cannot login to the chat room, until their punishment ended. These punishment can be used to users who disturb chat activity strictly and his/her behavior cannot be stopped with warnings. These administrative activities are designed as classroom management activities to control flow of the chat session. Using warnings and punsihments may stop actions or behaviors that interrupts flow of the chat session.

All chat activities can be logged by instructors or administrators using chat log part on the system module. Chat logs contain messages of any chat room at any date. Students can reach chat logs using chat logs part on the system module. By the way, they can see all chat messages. Chat activities are synchronous activities and all users should be online at the same time. Users sometimes cannot follow all chat session or miss some parts, by using chat logs these problems can be prevented.

There is no additional part designed for chat management. Forum management can be used for both purposes. All chat rooms have matching forums. In other words, all forums have chat room with same name.

3.5.5 Course Module

"Effective course design is the primary component of online student success." (Lynch, 2002, p.14) Course design must include following to be succesful.

- High rates of student participation
- Group interaction among students
- High quality of intellectual exchange
- Special metaphors used as mental models to help students adjust to an online structured course (Harasim, 1997; Lynch, 2002)

Course module is designed for publishing courses via CCMS. Courses can be system integrated or out-of-system courses. Main difference between them is that for system integrated courses all activities carried on system.

There are some integrated functions of course module. Students can take notes and can reach their notes using related links. They can ask questions to course instructors and they can follow their questions' status and answers. They can send message to the course forum as a new forum topic.

There are some functions available only for system integrated courses. Students can search in course content. They can bookmark any part of the course pages for future access. They can reach these bookmarks easily at any time they need.

The design of course module composed for main parts. At the top, it has title part, name of the course and the student are published here. At the bottom, it has general activities menu. This menu composed buttons and text links. Buttons are used for accessing other modules or activities made on other modules. Text links are related to active page. They open links or special areas that are used as integrated with course module. Taking notes, asking questions and creating new forum topic functions can be used with the small window opened at the bottom. Third part and forth part are available only for system integrated courses. Third part is available at the left and it includes tree menu of course content. And, forth and final part is lecture part. At this part, content of the course published. Important point for second and third part is that they can be hidden using buttons at the right and left bottom of the window.

Course module is related with other modules like forum and chat modules. Students can easily access these modules' related parts from course module. Students can also access course announcements, and exams and quizzes assigned for courses through course module.

3.5.6 Test Manager Module

"Quizzes and tests are another type of asynchronous interaction. Online quizzes and tests enable the instructor and learners to access progress or mastery of a topic." (Driscoll, 2002, p.142)

According Horton (2000), there are some advantages of online tests. Online tests:

- Let learners gauge progress toward their goals.

- Emphasize what is important and thereby motivate learners to focus on it.
- Monitor success of parts of the course so that the instructor and designers can improve it.
- Certify that learners have mastered certain knowledge or skills.

The main advantage of using a computer-marked quiz is that the learner receives instant feedback. That feedback can be as simple as right or wrong marks, or as complex as advice for remediation, explanations of what they did wrong, and reinforcement for what was correct. (Lynch, 2002, p.112)

According to Lynch (2002), there are several disadvantages of using online tests:

- Their outcomes is not always be reliable for accurate reflection of the learners' capabilities.
- Students may perceive these tests as impersonal.
- The tests may foster a false sense of confidence or failure, depending on their construction and purpose.
- The nature of the questions and answers may be very restricted.

Test manager is designed for creating and managing test for using with CCMS courses. Tests created with test manager may contain multiple choice, true-false and matching type questions. All questions types can be used in a single test.

Instructors or administrators can create tests and add questions to their tests. But, only instructors can assign these tests with courses. Instructors can see and use other instructors' or administrators' questions in their tests. But, they can neither see nor use other instructors' tests with their courses.

Test creation have several steps. Firstly, instructor or administrator needs to create test category. A test category contain information about test type and number of options questions of this category contain. There is no limitation for number of

questions added any category. Each user can add questions to only their categories, but they can see other users questions and categories.

After creation of test users need to add question to these categories using add new question parts. They can edit their questions any time they want, but they can only see other users' questions.

Third step of test creation is creating test to add questions. Test can be created with test name and detailed information about test. After test creation, instructors can add any question to their tests. There is no category or type limitations. A test may compose of all types questions. Instructors can modify these tests at any time.

Final step of test creation is assigning test to the courses. Assignment of tests with courses is the responsibility of instructors. Instructors can assign their tests to their courses. There are two different test types can be assigned to courses; exams and quizzes. Both test types can be created using same way. Discrimination between them made during assignment. Test assignment made on system module. During these process test's duration, validation date and test type should be selected.

3.6 Evaluation

During this study, a CCMS has been developed. And its usability is tested using heuristic evaluation usability inspection method.

3.6.1 Usability

Usability is the broad discipline of applying sound scientific observation, measurement, and design principles to the creation and maintenance of Web sites in order to bring about the greatest ease of use, ease of learnability, amount of usefulness, and least amount of discomfort for the humans who have to use the system. (Pearrow, 2000, p. 12)

According to Nielsen (1993), usability is not a single, one-dimensional property of a user interface. Usability has multiple components and is traditionally associated with these five usability attributes:

- *Learnability.* The system should be easy to learn so that the user can rapidly start getting some work done with the system.
- *Efficiency.* The system should be efficient to use, so that once the user has learned the system, a high level productivity is possible.
- *Memorability.* The system should be easy to remember, so that the casual user is able to return to the system after some period of not having used it, without having to learn everything all over again.
- *Errors.* The system should have a low error rate, so that users make few errors during the use of the system, and so that if they do make errors they can easily recover from them.
- *Satisfaction.* The system should be pleasant to use, so that users are subjectively satisfied when using it; they like it.

3.6.2 Usability Inspection

Usability inspection is the generic name for a set of methods based on having evaluators inspect or examine usability-related aspects of a user interface. Usability inspectors can be usability specialists, but they can also be software development consultants with special expertise (e.g., knowledge of a particular interface style for graphical user interfaces), end users with content or task knowledge, or other types of professionals. (Nielsen & Mack, 1994, p.1)

Usability inspection is aimed at finding usability problems in an existing user interface design, and then using these problems to make recommendation for fixing the problems and improving the usability of the design. This means that usability inspections are normally user at the stage in the usability engineering cycle when a user interface design generated and its usability (and utility) for users need to be evaluated. (Nielsen & Mack, 1994, p.3)

According to Nielsen & Mack (1994), there are eight usability inspection methods exist:

- *Heuristic evaluation* is the most informal method and involves having usability specialists judge whether each dialogue element conforms to established usability principles.
- *Guideline reviews* are inspections where an interface is checked for conformance with a comprehensive list of usability guidelines.
- *Pluaristic walkthrough* are meetings where users, developers, and human factors people step through a scenario, discussing usability issues associated with dialogue elements involved in the scenario steps.
- *Consistency inspections* have designers representing multiple projects inspect and interface to see whether it does things in a way consistent with their own design.
- *Standarts inspections* have an expert on some interface standart inspect the interface for compliance.
- *Cognitive walkthrough* use a more explicitly detailed procedure to simulate a user's problem-solving process at each step in the human-computer dialogue.
- *Formal usability inspections* are intented to be very similar to the code inspection methods with which many sofware developers are already familiar.
- *Feature inspections* focus on the function delivered in a software system; for example, whether the function as designed meets the needs of intended end users.

During this study, heuristic evaluation method will be applied. According to Nielsen (1995), (traditional) user testing and heuristic evaluation are the most effective two usability inspection methods.

In a user test situation, the observer (normally called the "experimenter") has the responsibility of interpreting the user's actions in order to infer how these actions

are related to the usability issues in the design of the interface. In contrast, the responsibility for analyzing user interface is placed with the evaluator in a heuristic evaluation session, so a possible observer only needs to record the evaluator's comments about the interface, but does not need to interpret the evaluator's actions. For traditional user testing, one normally wants to discover the mistakes users make when using the interface. For heuristic evaluation, evaluator's question will be used to assess the usability of the user interface with respect to the characteristics of the domain. (Nielsen & Mack, 1994)

"Eventhough heuristic evaluation finds many usability problems that are not found by user testing, it is also the case it may miss some problems that can be found user testing." Nielsen & Mack, 1994, p.57) Therefore, Nielsen & Mack (1994) advices using both methods alternatingly. According to Nielsen & Mack (1994), first, heuristic evaluation should be applied to clean up the interface and remove any "obivous" usability problems as possible. After a redesign of the interface, usability testing might be applied to find usability problems that were not found by heuristic evaluation.

During this study, heuristic evaluation is only be used. Using heuristic evaluation, most of the minor and major usability problems could be found. According to Nielsen & Mack (1994), using heuristic evaluation with five evaluators (experts), approximately 75% of the usability problems can be found. With 10 evaluators, more than %85 of the usability problems can be found.

During the study user testing is not preferred, since it is very hard to conduct and it requires extra time and special effort. During usability testing, random users will be used instead of experts. According to Pearrow (2000), "there is no predecting what random users will do; only they can create situations of complete functionality break down." (p.77) It is very hard to estimate what they will do. In constrast, heuristic evaluation is a good balanced test plan. (Pearrow, 2000) And, Nielsen & Mack (1994) said that "heuristic evaluation is a basic usability engineering method that is very easy to use." (p.61)

3.6.3 Heuristic Evaluation

Dictionary definition of heuristic is “involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods (heuristic techniques; a heuristic assumption); also, of or relating to exploratory problem-solving techniques that utilize self-educating techniques (as the evaluation of feedback) to improve performance (a heuristic computer program)” (Merriam-Webster Online Dictionary)

“Heuristic evaluation is a usability engineering method for finding the usability problems in a user interface design so that they can be attended to as part of an iterative design process.” (Nielsen & Mack, 1994, p.25) Heuristic evaluation’s range Nielsen & Mack (1994) as “Heuristic evaluation involves having a small set of evaluators examine the interface and judge its compliance with recognized usability principles (the ‘heuristics’).” (p.26)

According to Pearrow (2000), the heuristic evaluation technique is a very valuable tool for the initial assessment of the usability health of a Web site. A heuristic is a rule-of thumb; a heuristic evaluation is performed by an expert who analyzes a site and ranks it based on a standard list of usability heuristics” (p.76)

There are ten general principles for user interface design. They are called “heuristics” because they are more in nature of rules than specific usability guidelines. Nielsen & Mack (1994) listed these ten usability usability heuristics:

1. *Visibility of system status.*
2. *Match between system and the real world.*
3. *User control and freedom.*
4. *Consistency and standards.*
5. *Error prevention.*
6. *Recognition rather than recall.*
7. *Flexibility and efficiency of use.*
8. *Aesthetic and minimalist design.*

9. *Help users recognize, diagnose, and recover from errors.*
10. *Help and documentation.*

3.6.4 Heuristic Evaluation Checklist

During this study, a heuristic evaluation checklist developed by Pierotti (1995) was used. Pierotti (1995) developed a system checklist depended on ten usability heuristics of Nielsen & Mack (1994). During this study, modified version of this checklist was used. The aim of the checklist is to find common usability problems.

Checklist prepared using ten usability heuristics. Each heuristic tested asking questions related with these heuristics. There is a comment area exist for each questions to find other usability problems not included in the list. They aimed to improve the efficiency and increase reliability of the answers.

Usability checklist that will be used during this study composed of thirteen parts. First ten parts about usability heuristics defined by Nielsen & Mack (1994). Last three part is related to overall state of project and try to measure general objectives.

Parts of the checklist and their aims

1. *Visibility of system status:*

"The system should always keep users informed about what is going on, through appropriate feedback within reasonable time." (Nielsen & Mack, 1994, p.30) This means that users should know each step of their progress and they should be informed about results of their actions and they need to get feedback related with their actions.

According to Pearrow (2000), this part should inform users about what state the Web site is in at any moment. Visual attributes of project; general structure, easiness and helpfullness of the design will be tested.

2. *Match between system and the real world:*

“The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.” (Nielsen & Mack, 1994, p.30) This means that the system’s language should be easily understood by all users and technical terms and jargons should not be used. Conventions between real world and the system should be made in a natural and logical order.

According to Pearrow (2000), this heuristic composed of two parts:

- Use the natural language of the user, not jargon or system terms.
- Follow real-world conventions; provide natura mapping. (p.168)

From the first part, it can be deduced that user interface should not contain any jargon or system terms, users should easily understand the meaning of the terms. The second part related to complexity of the interface, interface should be easy to use and any extra effort and complex information should not be placed. At this part, complexity of structure and language of the interface will be tested.

3. *User Control and Freedom:*

“Users often choose system functions by mistake and will mistake and will need a clearly marked ‘emergency exit’ to leave the unwanted state without having to go through and extended dialogue. Support and redo” (Nielsen & Mack, 1994, p.30)

Pearrow (2000) classified this heuristic under three sub parts:

- Provide clearly marked exists
- Support undo and redo transactions
- Make it harder to perform irreversible actions

4. *Consistency and standards:*

“Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.” (Nielsen & Mack, 1994, p.30) It can be infered from this sentence that user interface should be consistent through all parts. In other words, all parts of the user interface should be similar to previous or next one. Users should not struggle with changes on user interface structure. Another concern here is that there should be a standard exist among messages, menus or prompts.

5. *Error prevention:*

“Even better than good error messages is a careful design which prevent a problem from occurring in the first place.” (Nielsen & Mack, 1994, p.30) Although they are necessary, error messages sometimes bore users and cause users to make more errors or to go out of the system. Therefore, error messages is not a simple solution to prevent users from making errors. One of the cause of users to make errors is overload of interfaces. Hence, user interfaces should be simple and easy to use, more than adequate amount of information should not be presented on them. Another concern is lack of hints, users sometimes need hints. Adding hints to required places prevent users making errors.

6. *Recognition rather than recall:*

“Make objects, actions and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.” (Nielsen & Mack, 1994, p.30)

“Humans are rarely required to remember all the features of any object by rote memory. Almost always, the world offers cues that help the human discriminate among various stimuli.” (Pearrow, 2000, p.176) Usability interfaces should include

cues, prompts and messages that aid to user to use interface without any extra effort. Also, consistency and visual characteristics of interface helps to user to use system easily.

7. *Flexibility and efficiency of use:*

“Accelerators – unseen by novice user – may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.” (Nielsen & Mack, 1994, p.30)

Interfaces can be developed for both novice and expert users. Experts users may reach some parts or do something easily than novice users. Since, novice may not perceive some parts. These are related to users’ cognitive or physical abilities.

8. *Aesthetic and minimalist design:*

“Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.” (Nielsen & Mack, 1994, p.30)

“Adding items to a page does not make it better; they usually make it worse if the addition isn’t carefully though out” (Pearrow, 2000, p.177) This means that the interface should not be overloaded, they should only contain required information. “The more information on a page, the poorer the signal-to-noise ratio.” (Pearrow, 2000, p.177)

9. *Help users recognize, diagnose, and recover from errors:*

“Error messages should be expressed in plain language (no codes), precisely indicate the problem, and consrustively suggest a solution.” (Nielsen & Mack, 1994, p.30)

Prompts and error messages sometimes prevent user from making errors. Error messages should inform users about the process and results.

10. *Help and documentation:*

“Eventhough it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user’s task, list concrete steps to be carried out, and not be to large.” (Nielsen & Mack, 1994, p.30)

Users need information about content and usage of menus, buttons or visual aids. System should supply information and documentation users need during usage.

11. *Skills:*

“The system should support, extend, supplement, or enhance the user’s skills, background knowledge, and expertise.” (Pierotti, 1995)

User’s skills and how they perceive and analyze system are among the important factors that affect usability of the system. Capabilities of the system to meet concerns supporting and supplementing users to enhance their skills and background knowledge are among the concerns of this part.

12. *Pleasurable and respectful interaction with the user:*

“The user’s interactions with the system should enhance the quality of her or his work-life. The user should be treated with respect. The design should be aesthetically pleasing- with artistic as well as functional value.” (Pierotti, 1995)

Interactivity is the most important component of online learning environments. Inveractivity of the system affects all system parts and their functionality. User content interaction is one of the interaction that should be exist on

online learning environments. User-content interaction affects the users view on the system. User interface and content design affects user-content interaction.

Another factor regarding this part is the capabilities of the system and how percent the system meets users' expectation.

13. *Privacy:*

"The system should help the user to protect personal or private information-belonging to the user or the his/her clients." (Pierotti, 1995) Secure systems help users to feel themselves confident. Privacy of the system may increase users' courage to the system and usage of the system.

3.7 Evaluators

There are 8 evaluators filled checklist. All evalutors can be accepted as specialist about instructional technology. 5 of the evaluators are Phd students and Research Assistants at Middle East Technical University under Computer Education and Instructional Technology department. 2 of the evaluators MS students at Middle East Technical University at Computer Education and Instructional Technology department. They are also graduated from this department. And last evaluator is MS student at Balıkesir University at Computer Education and Instructional Technology department. He works as a computer teacher at one of the public high schools. He was also graduated from Computer Education and Instructional Technology department of Middle East Technical University.

3.8 Data Collection

The checklist was published on the web-site. Filled checklists were stored on the database. At the end of data collection, results evaluated using the tool on the web-site.

Different student users were created for each evaluator. All user information and site url sended to evaluators. And, a page that includes information about the system was published on the web-site.

Evaluators logged in to the system using their usernames and passwords. They examined the system regarding criterias on the checklist and then they filled checklist.

3.9 Data Analysis

All data were taken through the web-site. And, they have combined on the same form. Data were resented as raw scores and percentages.

Data analysis procedure composed of two steps. First of all, mean scores of the 13 categories (heuristics) were evaluated to find major usability problems. Then, raw score of each item evaluated to find minor usability problems. During evaluation period, comments regarding items were also considered. All items and comments were inspected in detail.

CHAPTER 4

RESULTS & DISCUSSIONS

4.1 Introduction

Heuristic evaluation is one of the usability inspection method to find major and minor usability problems. During this study, CCMS's usability tested by using the checklist developed for heuristic evaluation. Checklist was developed by Pierotti (1995) and modified for this study. Checklist categorized into 13 parts. First 10 part is about ten usability heuristics found by Nielsen & Mack (1994). Last three parts are related with users cognition on general structure of the tool or web-site. A checklist used this study contains total 108 questions under 13 categories.

4.2 Results & Discussions

Usability of the system tested under 13 categories related with checklist used during testing. These categories can also be called as usability heuristics. Results of this test is revealed and interrogated according to these heuristics.

4.2.1 Visibility of System Status

Questions under this category mainly focused on consistency through the system and legibility and understandability of the user interface.

Table 4.1 Checklist Part 1 Results

Question	***Yes***	***%***	***No***	***%***	***NA****	***%***
Does every display begin with a title or header that describes screen contents	8	*100*	0	*0*	0	*0*

Table 4.1 Checklist Part 1 Results (cont.)

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Does every display begin with a title or header that describes screen contents	8	*100*	0	*0*	0	*0*
Is there a consistent icon design scheme and stylistic treatment across the system?	8	*100*	0	*0*	0	*0*
Do menu instructions, prompts, and error messages appear in the same place(s) on each menu?	5	*62.5*	1	*12.5*	2	*25*
In multi page data entry screens, is each page labeled to show its relation to others?	5	*71*	2	*29*	0	*0*
Is there some form of system feedback for every operator action?	5	*62.5*	1	*12.5*	2	*25*
Is there visual feedback in menus or dialog boxes about which choice the cursor is on now?	6	*75*	2	*25*	0	*0*
Is the current status of an icon clearly indicated?	5	*62.5*	3	*37.5*	0	*0*
Are response times appropriate to the task?	6	*75*	0	*0*	2	*25*
Does the system provide *visibility:* that is, by looking, can the user tell the state of the system and the alternatives for action?	6	*75*	2	*25*	0	*0*
Do GUI (Graphical User Interface) menus make obvious which item has been selected?	7	*87.5*	1	*12.5*	0	*0*
Mean	6.1	*77.5*	1.2	*15*	0.6	*7.5*

[*] *NA=Not Applicable*

According to test results, there is no major or distinguishable problem found related with visibility of the system. But, there are some improvements needed at some parts of the system.

Each page of the system begins with title or header. They contain information about page content and some of them contains buttons regarding related actions. Mandel (1997) accepts this as a necessary aspect of any graphical user interface and says that “users must know where they are, what they are doing, and what they can do next”. (p.65)

Places of instructions, prompts and error messages change with the menu structure. Their places depend on the aims and structures of the modules. For example, at the system module, all instructions and prompts are given at the middle part. At the course module, they are given through pop-up windows.

All menus of the system are not designed using the same menu structure. Different types of menus used at different modules and different parts of these modules. At some menus, there is no hover action and there is no prompt or hint for these actions. Adding prompts or hover actions to these buttons may increase understandability of these buttons or icons. Mandel (1997) stresses this point and says that menus are easy to learn and easy to remember and menus should not require users to remember information from a previous menu or screen in order to make a selection on a current menu.

There is no need for feedback for each user action. Feedback and instructions are given for user actions that have important consequences. According to Roval (2001), feedback should be forthcoming and constructive to users actions.

As a consequence, at some screens improvements on page design may be useful. Prompts in these pages and titles of these pages might be improved to increase functionality and usability of these pages.

4.2.2 Match Between System and The Real World

Questions under this category aimed to measure complexity of the structure, familiarity of the interface with the user, and completeness of the user interface.

Table 4.2 Checklist Part 2 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Are icons concrete and familiar?	8	*100*	0	*0*	0	0
If there is a natural sequence to menu choices, has it been used?	6	*100*	0	*0*	0	0
Do related and interdependent fields appear on the same screen?	5	*62.5*	3	*37.5*	0	0
Do the selected colors correspond to common expectations about color codes?	5	*62.5*	3	*37.5*	0	0

Table 4.2 Checklist Part 2 Results (cont.)

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
When prompts imply a necessary action, are the words in the message consistent with that action?	6	*86*	1	*14*	0	0
On data entry screens, are tasks described in terminology familiar to users?	7	*87.5*	1	*12.5*	0	0
Are field-level prompts provided for data entry screens?	4	*57*	2	*29*	1	14
Do menu choices fit logically into categories that have readily understood meanings?	8	*100*	0	*0*	0	0
Mean	6.1	*82*	1.3	*16*	0.1	2

According to test results, there is no major problem exist related with this part. All menus and icons are concrete and familiar with the user.

At some parts, forms and colors need to be improved. And, at some places of user interface design should be improved. According to Murch (1984); “Properly used, color can be a powerful tool to improve the usefullness of an information display system. The inappropriate use of color can seriously reduce the performance of such a system, however.” (as cited in Mandel, 1997, p.299)

Prompts related with some parts espacially at the field levels are not clear enough and they need to be improved. In general, terminology used in the system found familiar to the users. There is no contradiction with Mandel (1997)’s suggestion: “use terms that users can understand, rather than system or developer terms.” (p.57)

Finally, it can be said that problems under this part does not affect overall state of the project. With some improvements of some parts, problems under this part may completely be removed.

4.2.3 User Control ad Freedom

Questions of this part related to control and navigation of the user interface. Another concern of this part is given freedom to users.

Table 4.2 Checklist Part 3 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
If setting up windows is a low-frequency task, is it particularly easy to remember?	*7*	*87.5*	*0*	*0*	*1*	*12.5*
In systems that use overlapping windows, is it easy for users to switch between windows?	4	*50*	3	*37.5*	1	*12.5*
Are users prompted to confirm commands that have drastic, destructive consequences?	5	*62.5*	2	*25*	1	*12.5*
Is there an "undo" function at the level of a single action, a data entry, and a complete group of actions?	0	*0*	6	*75*	2	*25*
Are menus broad (many items on a menu) rather than deep (many menu levels)?	3	*37.5*	3	*37.5*	2	*25*
If the system has multiple menu levels, is there a mechanism that allows users to go back to previous menus?	7	*87.5*	1	*12.5*	0	*0*
Can users move forward and backward between fields or dialog box options?	6	*86*	0	*0*	1	*14*
Can users set their own system, session, file, and screen defaults?	0	*0*	8	*100*	0	*0*
Mean	4	*51*	2.9	*36*	1	*13*

From test results, it can be concluded that there are some minor problems exist regarding user control and freedom part.

One of these problems is that lack of undo functions for single user actions. Mandel (1997) suggest providing multiple levels of undo and redo for encouraging users to explore programs without fear. According to Mandel (1997), users should be informed if an action cannot be undone, and they should be allowed to choose alternative actions. But, this condition does not affect overall state and usability of the system. There is no need for undo functions at most parts of the system. Users may usually remove unwanted results of their actions with the help of other parts of the

system. Another point here is that most of the user actions do not have destructive consequences, so there is no need undo functions for these actions.

Another minor problem seems the amount of control given to the users. Users have some control on some parts of the system, but they cannot set their own settings. Brush & Saye (2000) and Mandel (1997) mention the necessity of user control. According to Brush & Saye (2000), users need structured environments, otherwise they will have difficulty with lack of structure. Mandel (1997) accepts "placing users in control" among the golden rules of the user interface design. Sometimes giving lots of authority to users on the system may decrease usability of the system. According to Mandel (1997), "wise designers let users do their work for them rather than attempting to figure out what they want." (p.52) Control given to the users may be increased to some extent. According to Mandel (1997), "the interface should give users some degree of control and flexibility to do their tasks quickly, comfortably, and efficently." (p.52) As a result, having some disadvantages, increasing user rights on the system may increase users interest and encouragement to the system. Mandel (1997)'s suggestion at this point is that if the power given to users to change the interface, it must also be supplied to users to reset choices and preferences to system or program defaults.

All modules opened on new windows and opening multiple windows at the same time may decrease usability of the system for some users. On the other hand, running more than one module at the same time can be advantageous for most users. In this way, users can send messages or follow courses when he or she is being active at chat pages. Exiting from one module does not affect other modules. As long as the system module is active, users accepted online and they can use any module of the system. When they exited from the sytem module, they accepted offline and they cannot do anything on any of the modules. Usability programs regarding multiple windows may easily be removed with enough justifications.

Menus are not very broad at most of the system. Main menu structure is tree menu (horizontol or vertical), therefore most of the menus splited into sub parts. For this reason, most menus have a few items. However, depending on the course

content, the course content menu might have lots of items. Navigation on menus is easy and menu items usually clear to understand. At some point, functions of menus cannot be easily undertood, these menus can be improved by adding hints or prompts.

There is no destructive actions present on the system. Consequences of most of the actions on the system can be removed with the help of other parts. For example, administrators are the most powerfull users on the system, and their main duty is user registration. Most destructive actions that administrators can do is deleting user accounts, but this is not an easy process. To delete any user account, administrators have to follow two or more steps. They can go back from any step. Confirmation messages exist on most parts of the system. For other parts, these messages can be added. Although their consequences may be removed easily, confirmation messages may be helpful at some parts of the system and they may increase usefullness of these parts and the system.

Except some minor problems, there is no major problem found related with this part.

These minor problems does not have effect on overall state of the system. Some of these problems cannot be accepted as a usability problem that affects usefullness of the system, since they are necessary for controlling overall system structure and effectiveness of the system.

Eventually, making some improvements on menus, status of windows and user tasks may increase usefullness of the system.

4.2.4 Consistency and Standards

At this part, consistency of the user interface through all parts either menus, structure or navigation will be measured.

Table 4.4 Checklist Part 4 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Has a heavy use of all uppercase letters on a screen been avoided?	*6*	*86*	*1*	*14*	*0*	*0*
Are icons labeled?	4	*50*	3	*37.5*	1	*12.5*
Does each window have a title?	8	*100*	0	*0*	0	*0*
Is vertical and horizontal scrolling possible in each window?	6	*86*	0	*0*	1	*14*
Does the menu structure match the task structure?	8	*100*	0	*0*	0	*0*
Are menu choice lists presented vertically?	8	*100*	0	*0*	0	*0*
Are menu titles either centered or left-justified?	7	*87.5*	1	*12.5*	0	*0*
Are field labels consistent from one data entry screen to another?	7	*100*	0	*0*	0	*0*
Are gaining attention techniques (intensity, size, font, color) used with care?	6	*75*	0	*0*	2	*25*
Is the most important information placed at the beginning of the prompt?	7	*87.5*	1	*12.5*	0	*0*
Are user actions named consistently across all prompts in the system?	8	*100*	0	*0*	0	*0*
Are system objects named consistently across all prompts in the system?	8	*100*	0	*0*	0	*0*
Is high-value, high-chrome colors used to attract attention?	3	*37.5*	3	*37.5*	*2*	*25*
Mean	6.6	*85*	1.1	*9*	0.8	*6*

Test results shows that there is no clear major usability problem found regarding consistency. Mandel (1997) defines consistency as “a key aspect of usable interfaces” (p.72) and accepts consistency among the golden rules of the user interface design. And, according to Graham, Cagiltay, Craner, Lim, & Duffy (2000) “consistency in the interface allows people to easily learn and recognize the graphic language of the interface.” (p.11)

Test results show that there is a consistency exist among pages and menus of the system, regarding their structures and objects used under pages.

Although it is a consistent system, some improvements needed at some parts of the system. At the course module, some of the icons used without text for space saving and as a complement of the user interface. This may cause some problems. Some users may have difficulty with understanding functions of these

icons or buttons, although functions of these icons explained at the help part. Changing icons with clear and more understandable ones might be better. This is not obligatory, since this condition will not have considerable effect on the usability of this module.

Mandel (1997) advices using appropriate menus to the interface environment and the tasks users trying to perform, both text and graphical menus can be used. Menus used in the system are mainly text-based; horizontal cascading tree or vertical menus. At some parts, espacially in the course module, horizontal menu is also used. At the course module, there are two different types of menus present: course content and general menu. Course content menu includes links regarding courses and course related actions and changes with courses. General menu of the course module is different from content menu. They are common for all courses and all users. Most of the general menu elements make connection between course module and other modules. Others are related with course related functions; e.g. take notes, ask question to instructor, search in the course content.

There is no problem with other usability issues under this part. At most part of the system mix of upper and lower case letters preferred instead of all upper or lower case letters. Pierotti (1995b) and Fahy (2004) advice using mix of upper and lower case. Each window of the system has title, since users need to know where they are and what they are doing. Both horizontal and vertical scrolling is possible, but it is not preferred. Horizontal scrolling is available only for users who use lower resolution than system support. Vertical scrolling is available all modules except course module. At course module, except content menus, there is no vertical or horizontal scrolling available if users do not have resolution problem. On the content menu, for some of the menu items scrolling is available because of the its limited area. Scrollbars appear only few of the pages. Therefore, there is no controduction exist with Nielsen (1996) and Tang (2000)’s advice on minimizing scrolling on navigation pages.

Eventually, it can be easily said that this system is a consistent system.

4.2.5 Error Prevention

At this part, the mechanism developed to prevent users from making errors or making wrong actions will be tested.

Table 4.5 Checklist Part 5 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Are menu choices logical, distinctive, and mutually exclusive?	*8*	*100*	*0*	*0*	*0*	*0*
If the system displays multiple windows, is navigation between windows simple and visible?	6	*75*	2	*25*	0	*0*
Does the system prevent users from making errors whenever possible?	5	*62.5*	2	*25*	1	*12.5*
Does the system warn users if they are about to make a potentially serious error?	3	*37.5*	2	*25*	3	*37.5*
Do data entry screens and dialog boxes indicate the number of character spaces available in a field?	1	*12.5*	5	*62.5*	2	*25*
Do fields in data entry screens and dialog boxes contain default values when appropriate?	3	*37.5*	2	*25*	3	*37.5*
Mean	4.3	*54*	2.2	*27*	1.5	*19*

Error prevention one of the important part of learning environments, since users usually have a tendency to make errors. Govindasamy (2002) stressed importance of support as “in e-learning settings, all possible types of problems student are likely to face have to be foreseen in advance in order to introduce performance support.” (p.294)

According to results, there is no problem with menus and navigation. System has some parts that give information about functions of these parts. But, the content of the information parts is very limited and users may not get the information they needed. Lack of warning mechanism of some part may be accepted as one of the missing point of this part. Although students cannot make any serious error, warning mechanism exists all of the student parts. Warning mechanism does not exist some of the administration parts. But, this condition does not cause any problem, since most of the administrative activities does not have destructive resources directly.

Users can go back and change their mistakes, espacially for registration related activities. Adding confirmation and warning messages to some parts may increase efficiency of these parts and the system. Another point here is that there is no control on the limit of boxes and type of information entered these boxes. All the information checked on submitted pages, adding some controls before submission might be more effective.

For all, it can be said that making some improvements on the system and adding some controls regarding error preventation may increase efficiency of the system.

4.2.6 Recognition Rather Than Recall

Questions of this part usually related with visual attributes, aids supplied and consistent design of the interface.

Table 4.6 Checklist Part 6 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
For question and answer interfaces, are visual cues and white space used to distinguish questions, prompts, instructions, and user input?	8	*100*	0	*0*	0	*0*
Are all data a user needs on display at each step in a transaction sequence?	8	*100*	0	*0*	0	*0*
Are prompts, cues, and messages placed where the eye is likely to be looking on the screen?	8	*100*	0	*0*	0	*0*
Have prompts been formatted using white space, justification, and visual cues for easy scanning?	7	*87.5*	0	*0*	1	*12.5*
Is white space used to create symmetry and lead the eye in the appropriate direction?	8	*100*	0	*0*	0	*0*
Is size, boldface, underlining, color, shading, or typography used to show relative quantity or importance of different screen items?	8	*100*	0	*0*	0	*0*
Are borders used to identify meaningful groups?	8	*100*	0	*0*	0	*0*
Has the same color been used to group related elements?	8	*100*	0	*0*	0	*0*
Is color coding consistent throughout the system?	8	*100*	0	*0*	0	*0*
Is there good color and brightness contrast between image and background colors?	7	*87.5*	1	*12.5*	0	*0*

Table 4.6 Checklist Part 6 Results (cont.)

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Have light, bright, saturated colors been used to emphasize data and have darker, duller, and desaturated colors been used to de-emphasize data?	6	*75*	1	*12.5*	1	*12.5*
Is the first word of each menu choice the most important?	3	37.5	2	*25*	3	*37.5*
Does the system provide *mapping:* that is, are the relationships between controls and actions apparent to the user?	3	43	4	*57*	0	*0*
Mean	6.9	87.5	0.6	*7.5*	0.4	*5*

Considering test results, there is no clear major and minor problems exist on this part.

There are visual cues exist to distinguish questions, prompts, instructions, and user input. Mandel (1997) mentions the necessity of visual cues as: “whenever users are in a mode, or are performing actions with the mouse, there should be some visual indication somewhere on the screen that they are in that mode.” (p.66)

Most of the menus are very simple and users can easily understand their functions. Providing simple and easy menus is also adviced by Mandel (1997). For preserving clarity and simplicity of menu items, at some of the menu items instead first one, second or combination of both can be the most important part of these menu items.

In addition to these, students do not have to struggle with complex actions, their actions usually simple and easy to complete. More complex actions mainly appear on administrator and instructor parts. Instructors and administrators are much more experienced users than students, therefore they may complete more complex actions without needing detailed information regarding relationships between controls and actions. Information showing relationships between buttons and their actions mainly presented on help parts.

According to test results, there is no problem with design, clarity and legibility of the user interface. All the menu items, colors, prompts and user areas used in the interface design are accepted as consistent. They do not have any negative effect on usability of the system.

4.2.7 Flexibility and Efficiency of Use

Flexibility may be accepted as an important factor for multi-user environments. All users have different capabilities and they perform their jobs at different ways and different times. Questions under this part aim to measure flexibility of the system and efficiency of using system parts.

Table 4.7 Checklist Part 7 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Can users define their own synonyms for commands?	2	*25*	4	*50*	2	*25*
Does the system provide function keys for high-frequency commands?	0	*0*	3	*37.5*	5	*62.5*
If menu lists are short (seven items or fewer), can users select an item by moving the cursor?	5	*62.5*	2	*25*	1	*12.5*
If the system uses a pointing device, do users have the option of either clicking on fields or using a keyboard shortcut?	6	*75*	0	*0*	2	*25*
On data entry screens, do users have the option of either clicking directly on a field or using a keyboard shortcut?	6	*75*	1	*12.5*	1	*12.5*
On menus, do users have the option of either clicking directly on a menu item or using a keyboard shortcut?	4	*50*	2	*25*	2	*25*
Mean	3.8	*48*	2.0	*25*	2.2	*27*

System does not have some functions regarding flexibility. In order to control learning environment and user actions, limited authority given to the users. Users cannot make any changes on the user interface and the system structure. The only and major limitation for users is that they cannot customize user interface and the system. Customization is a difficult process and it includes lots of controls, that may increase load of the system and may cause slower runtime. For similar reasons,

Williams (2002a) advices supplying flexibility without customization on programming. On the other hand, Mandel (1997) advices allowing users to customize user interface. According to Mandel (1997), “users feel more comfortable and in control of the interface if they can personalize it.” (p.61)

This is a web-based environment, there is no command based environment. All user actions can be done through menus and buttons. So, there is no need for synonyms for most of the user actions. Adding function keys or user-specific area for most used user actions may be useful. According to Mandel (1997), using shortcuts or functions keys may shorten some actions. But, shortcuts can be used at web-based environments to some extent.

For using accelerators or user specific functions or shortcuts, users may need extra support. For this reason, support parts should be improved before making any arrangements for accelerators and user specific functions. Adding customizable user specific areas to system may increase users interest to the system, and this might also increase usefullness of the system.

According to test results, there are some problems exists regarding flexibility, but these may be removed by making some arrangements and additions to the system. This is a web-based system, lack of some controls does not affect on the usability of the system. Most of the functions users may need present on the system, so they may not need user-specific arrangements or controls. And, according to Levin, & Levin, Buell, Waddoups (2002) flexibility in the program should allow students to shape the program their own needs to some extent.

4.2.8 Aesthetic and Minimalist Design

Questions related to this heuristic aimed to found problems related to legibility, briefness, and excessive use of buttons or texts.

Table 4.8 Checklist Part 8 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Is only (and all) information essential to decision making displayed on the screen?	8	*100*	0	*0*	0	*0*
Are all icons in a set visually and conceptually distinct?	8	*100*	0	*0*	0	*0*
Does each icon stand out from its background?	8	*100*	0	*0*	0	*0*
Are meaningful groups of items separated by white space?	8	*100*	0	*0*	0	*0*
Does each data entry screen have a short, simple, clear, distinctive title?	8	*100*	0	*0*	0	*0*
Are field labels brief, familiar, and descriptive?	8	*100*	0	*0*	0	*0*
Are prompts expressed in the affirmative, and do they use the active voice?	5	*62.5*	2	*25*	1	*12.5*
Is each lower-level menu choice associated with only one higher level menu?	7	*87.5*	0	*0*	1	*12.5*
Are menu titles brief, yet long enough to communicate?	8	*100*	0	*0*	0	*0*
Mean	7.6	*94*	0.2	*3*	0.2	*3*

According to Kobbenes and Folkman (2003), minimalist design should be considered not only for aesthetic purposes, but also for learning.

It can be easily inferred from results that there is no usability problem exist regarding aesthetic and minimalist design part. Results show that content and design of the screen, design and settlement of the icons, and status of menus are brief and clear enough. All pages have titles, and all labels and titles are clear and descriptive. In addition, there is no legibility problem regarding screen design, menus and settlement of buttons.

Results show that interface and structure of the system is simple and easy to use. This condition is suitable with suggestions of Allen & Eckols (1997). According to Allen & Eckols (1997) (cited in Kobbenes and Folkman, 2003), interface should be kept simple because simplicity reduces the demand on users' brain power and focuses users' attention on the task, and simplicity should be strived in layout, screen function, structural design and other program elements.

4.2.9 Help Users Recognize, Diagnoze, and Recover From Errors

At this stage, questions related the efficiency of error messages and prompts will be tested.

Table 4.9 Checklist Part 9 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Are prompts stated constructively, without overt or implied criticism of the user?	7	*87.5*	1	*12.5*	0	*0*
Do prompts imply that the user is in control?	5	*62.5*	1	*12.5*	2	*25*
Are prompts brief and unambiguous?	8	*100*	0	*0*	0	*0*
Are error messages worded so that the system, not the user, takes the blame?	3	*37.5*	1	*12.5*	4	*50*
Do all error messages in the system use consistent grammatical style, form, terminology, and abbreviations?	6	*75*	1	*12.5*	1	*12.5*
Do messages place users in control of the system?	6	*86*	0	*0*	1	*14*
Do error messages inform the user of the error's severity?	3	*43*	1	*14*	3	*43*
Do error messages suggest the cause of the problem?	4	*50*	2	*25*	2	*25*
Do error messages indicate what action the user needs to take to correct the error?	6	*75*	1	*12.5*	1	*12.5*
Mean	5.3	*69*	0.9	*11*	1.6	*20*

According to test results, there is no major or minor usability problem found on this part. However, making some improvements on some messages might be usefull and may increase usability of the system.

Test results show that there should be some improvements needed on prompts and error messages. On the grounds of system’s structure, there is not many error messages exist on the system. System have a mechanism to prevent users to make errors, but at some parts system inform users regarding their actions. Prompts and messages at some parts may not be clear and may not inform users about the severity and importance of their actions, so some of these messages need to be modified.

4.2.10 Help and Documention

Questions used at this part related to general structure and accesibility of help and documentation part.

Table 4.10 Checklist Part 10 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Do the instructions follow the sequence of user actions?	*6*	*75*	*1*	*12.5*	*1*	*12.5*
If menu choices are ambiguous, does the system provide additional explanatory information when an item is selected?	5	*62.5*	1	*12.5*	2	*25*
Is the help function visible; for example, a key labeled HELP or a special menu?	7	*87.5*	0	*0*	1	*12.5*
Is the help system consistent with the interface of the application?	7	*87.5*	0	*0*	1	*12.5*
Navigation: Is information easy to find?	7	*87.5*	0	*0*	1	*12.5*
Presentation: Is the visual layout well designed?	8	*100*	0	*0*	0	*0*
Conversation: Is the information accurate, complete, and understandable?	8	*100*	0	*0*	0	*0*
Is there context-sensitive help?	1	*12.5*	4	*50*	3	*37.5*
Is it easy to access and return from the help system?	7	*87.5*	1	*12.5*	0	*0*
Mean	6.2	*77.5*	0.8	*10*	1.0	*12.5*

Content-sensitive help is the missing point of the system. Help parts of the system mainly gives information about the whole part or section. Adding help regarding specific parts may be useful, this kind of help might be given using small pop-up windows with the help of specific buttons or functions.

The content of the help parts need to be improved. Help on some parts does not give enough information that users need. Riching content and clarity of the help parts may increase usefullness of these parts and the system. According to one of our evaluators, and Kobbenes and Folkman (2003), adding troubleshooting part might also be useful and increase usefullness of help parts.

System includes information regarding user actions. Menus or selected parts include information about functions of these parts. There is no problem regarding layout of the system, users can reach all system parts without difficulty.

To summarize, there is no major problem exist regarding help and documentation parts of the system. Improvements on help content and structure may increase usefullness and effectiveness of the system.

4.2.11 Skills

Questions under this category aim to measure the system's functions are suitable for user's needs and skills.

Table 4.11 Checklist Part 11 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Are window operations easy to learn and use?	*8*	*100*	*0*	*0*	*0*	*0*
Are users the initiators of actions rather than the responders?	5	*63*	1	*13*	2	*25*
When the user enters a screen or dialog box, is the cursor already positioned in the field users are most likely to need?	5	*63*	2	*25*	1	*13*
Can users move forward and backward within a field?	6	*75*	0	*0*	2	*25*
Is the method for moving the cursor to the next or previous field both simple and visible?	8	*100*	0	*0*	0	*0*
Do the selected input device(s) match user capabilities?	6	*75*	0	*0*	2	*25*
Does the system correctly anticipate and prompt for the user's probable next activity?	5	*71*	2	*29*	0	*5*
Mean	6.1	*78*	0.7	*9*	1.0	*13*

Test results show that there is no major or minor problem exist regarding this part. According to test results, windows of system are easy to learn and easy to use. Except pages that contains reach text editors, cursor positioned at the first item of the lists. On the pages that contains reach text editor, cursor positioned on the text area. This may sometimes affect users and usability of these parts.

There is no problem related with movement among fields or pages. Main input devices is keyboard and most of the actions can be done using keyboard. Navigation and selection activities must done using mouse instead of keyboard, doing these actions using keyboard very hard to accomplish. Most of the actions depend on only one activity. Therefore, there is no need on the system using group of actions. Most pages contain information regarding buttons on these pages and aims of these pages, therefore there is no prompt exist regarding next activity. Group of actions occur by themselves, therefore there is no need for extra information.

Actions on the system do not occur by itself. This means that users should start any action to occur. At some positions, users may be in the responders state, but this does not mean that this action occurs itself. There must be any initiator to be present for any action to occur.

As a conclusion, making some improvements on the system regarding this part might be useful. By the way, much more users expectations from the system might be met.

4.2.12 Pleasurable and Respectful Interaction with the User

This category concerns the interactivity of the system. Questions under this category aim to measure supplied interaction meets users' expectations.

Table 4.12 Checklist Part 12 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Is each individual icon a harmonious member of a family of icons?	*6*	*75*	*1*	*12.5*	*1*	*12.5*
Has excessive detail in icon design been avoided?	6	*75*	2	*25*	0	*0*
Has color been used with discretion?	6	*86*	0	*0*	1	*14*
Has the amount of required window housekeeping been kept to a minimum?	8	*100*	0	*0*	0	*0*
Has color been used specifically to draw attention, communicate organization, indicate status changes, and establish relationships?	4	*50*	1	*12.5*	3	*37.5*
Is the organization of the system easy to follow?	8	*100*	0	*0*	0	*0*

Table 4.12 Checklist Part 12 Results (cont.)

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Does the system have all the functions and capabilities user expects from it?	6	*86*	1	*14*	0	*0*
Mean	6.3	*82*	0.7	*9*	0.7	*9*

According to test results, there is no major or minor usability problem exist regarding this part.

There is no clear problem exist related with icon design and distribution of icons. Design of window and system are not overloaded and easy to follow. Colors used in design accepted effective. But, there is a problem regarding with colors used for gaining attention. At some parts of the system, there is no need for using colors to gain attention, and therefore these parts do not contains any color difference for gaining attention.

Most of the evaluators aggree on the idea that system meet expectations of all users. This does not mean that system does not need any improvements. Improvements on the system may increase capabilities of the system. By the way, most of the expectations of users could be met.

4.2.13 Privacy

Questions under this category related with pravity of the system.

Table 4.13 Checklist Part 13 Results

Question	***Yes***	***%***	***No***	***%***	***NA***	***%***
Are protected areas completely inaccessible?	7	*87.5*	1	*12.5*	0	*0*
Can protected or confidential areas be accessed with certain passwords?	8	*100*	0	*0*	0	*0*
Is this feature effective and successful?	8	*100*	0	*0*	0	*0*
Mean	7.7	*96*	0.3	*4*	0	*0*

Users sometimes have private information and they want to hide these from other users. Only registered users can access to the system. Unregistered users cannot reach any part of the system. They can only reach introduction pages. These pages includes information about the structure and functions of the system.

Administrators can reach most of the information on the system, but they cannot reach user specific informations. All messages sended through the messaging module and accepted private, none of users cannot reach other users' private messages. Another privacy is on password, all password related information stored on the database with encryption. There is one way crypting for these actions.

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

During this study a CCMS designed and developed, and its usability tested with Nielsen & Mack (1994)'s heuristic evaluation method. Heuristic evaluation method applied using Pierotti (1995)'s system checklist.

Main research question aimed to measure participants' perceptions about course-content management system. When main research question and its sub questions evaluated, following outcomes were reached:

- Interface of the system is simple and clear, most users can easily understand functions of menus and pages.
- Structure of the system was found useful, all menus, items and buttons were distributed in a harmony. Navigation among pages and system parts is easy to conduct.
- System control most user actions, creating user specific parts might be useful.
- It is a consistent system, there is a consistency exist among all page designs.
- Error prevention activities in the system is not enough, so they need to be improved
- Instructions, prompts, and messages on the user interface are clear enough, most users can easily understand them.
- System is not flexible. User specific actions do not present on the system.

- There is a harmony exist among screen designs. Icons and items are placed harmoniosly.
- Error messages and prompts in the system are usually clear and they can easily be understood. But, they need to be improved.
- Help and documentation parts of the system is important and they need to be improved.
- Most users can easily use the system.
- Interactivity on the system is high, system meets most users' expectations.
- System can be accepted as private, most user actions regards specific users.

Eventhough it is a usable system. There should be some improvements made on the system. Course-content management systems should include good documentation and help parts, therefore help and documentation parts of the system should be improved. This will increase effectiveness of the system. Imrovements on system messages and prompts will also increase effectiveness of the system. Flexibility is an another and important concern for course-content management systems. Adding flexibility to these systems will increase their success. Therefore, flexibility of the learning environment should be increased.

5.2 Recommendations

5.2.1 Further Research

During this study a heuristic evaluation method was applied. Heuristic evaluation is a good and useful method for evaluating programs before implementation phase. With heuristic evaluation method, minor and major usability problems on user interfaces and systems could easily be found. Heuristic evaluation mainly designed for expert-review purpose. Since, experts can find much more usability problems than random users.

Heuristic evaluation accepted as the most effective method to find usability problems before production phase. (Nielsen & Mack, 1994) But, using heuristic evaluation most of the usability can be found, but not all of them. “Eventhough heuristic evaluation finds many usability problems that are not found by user testing, it is also the case that it may miss some problems that can be found by user testing.” (Nielsen & Mack, 1994, p.57) Heuristic evaluation and user testing each finds usability problems overlooked by the other method, it is recommended that both methods be used.” (Nielsen & Mack, 1994, p.57) Nielsen & Mack (1994) and Nielsen (1995) advices using heuristic evaluation before applying user testing. Since, applying heuristic evaluation and finding major and minor usability with heuristic evaluation is easier than applying user testing. According to Nielsen & Mack (1994), heuristic evaluation may firstly be used to clean up the interface and remove many “obvious” usability problems as possible. After usability problems are cleaned, user testing method can be applied to find remaining usability that were not picked up by the heuristic evaluation.

When this study considered, heuristic evaluation is applied and some minor problems found. As a further research, after removing these problems and making necessary improvements on the system, user testing method can be applied to find usability problems that cannot be found using heuristic evaluation.

5.2.2 Design and Development

Designing and developing course-content management system is a systematic process. Before design, users needs should be investigated.

During the design, simplicity and clarity of the user interface are two important factors that affects usability of the user interface. Simplicity does not mean simple and blank user interfaces. Interfaces should contain all the functions, but all system functions should easily be reached and used. Consistency through the system is another important factor. Consistency helps users to follow and use the system easily without needing any extra information or ability.

Support given to users is very important for success of the CCMS. Support should be given at any state of the system. Higher support means less problem. Another support activity is help and documentation part. Help and documentation parts of the system should be designed carefully. These parts should include all information that users may need.

Prompts and hints on the system are also important for usefulness of the system. Prompts and hints should be used to support users during system usage without needing any other function. By the way, users may easily understand system parts and their functions.

As a consequence, it can be said that clarity, simplicity and consistency have lots of affect on usability of a CCMS and they should be considered during design phase. In addition, user support and help parts are very important for usefulness of a CCMS. Also, using prompts and hints will increase understandability and usability of a CCMS.

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APPENDIX A

HEURISTIC EVALUATION CHECKLIST

Heuristic Evaluation - A System Checklist

System Title : _____

Evaluator : _____

Date : _____

Usability Techniques / Heuristic Evaluation - A System Checklist

By Deniese Pierotti, Xerox Corporation

Modified By Hamdi Kavaklı

Primary Source

Making Computers-People Literate. © Copyright 1993.

By Elaine Weiss

ISBN: 0-471-01877-5

Secondary Source

Usability Inspection Methods. © Copyright 1994.

By Jakob Nielsen and Robert Mack

ISBN: 1-55542-622-0

A.1. Visibility of System Status

The system should always keep user informed about what is going on, through appropriate feedback within reasonable time.

#	Review Checklist	Yes	No	N/A	Comments
1.1	Does every display begin with a title or header that describes screen contents?	O	O	O	
1.2	Is there a consistent icon design scheme and stylistic treatment across the system?	O	O	O	
1.3	Do menu instructions, prompts, and error messages appear in the same place(s) on each menu?	O	O	O	
1.4	In multi page data entry screens, is each page labeled to show its relation to others?	O	O	O	
1.5	Is there some form of system feedback for every operator action?	O	O	O	
1.6	Is there visual feedback in menus or dialog boxes about which choice the cursor is on now?	O	O	O	
1.7	Is the current status of an icon clearly indicated?	O	O	O	
1.8	Are response times appropriate to the task?	O	O	O	
1.9	Does the system provide *visibility:* that is, by looking, can the user tell the state of the system and the alternatives for action?	O	O	O	
1.10	Do GUI (Graphical User Interface) menus make obvious which item has been selected?	O	O	O	

A.2. Match Between System and the Real World

The system should speak the user's language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

#	Review Checklist	Yes	No	N/A	Comments
2.1	Are icons concrete and familiar?	O	O	O	
2.2	If there is a natural sequence to menu choices, has it been used?	O	O	O	
2.3	Do related and interdependent fields appear on the same screen?	O	O	O	
2.4	Do the selected colors correspond to common expectations about color codes?	O	O	O	
2.5	When prompts imply a necessary action, are the words in the message consistent with that action?	O	O	O	
2.6	On data entry screens, are tasks described in terminology familiar to users?	O	O	O	
2.7	Are field-level prompts provided for data entry screens?				
2.8	Do menu choices fit logically into categories that have readily understood meanings?	O	O	O	

A.3. User Control and Freedom

Users should be free to select and sequence tasks (when appropriate), rather than having the system to do this for them. Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Users should make their own decisions (with clear information) regarding the costs of exiting current work. The system should support undo and redo.

#	Review Checklist	Yes	No	N/A	Comments
3.1	If setting up windows is a low-frequency task, is it particularly easy to remember?	O	O	O	
3.2	In systems that use overlapping windows, is it easy for users to switch between windows?	O	O	O	
3.3	Are users prompted to confirm commands that have drastic, destructive consequences?	O	O	O	
3.4	Is there an "undo" function at the level of a single action, a data entry, and a complete group of actions?	O	O	O	
3.5	Are menus broad (many items on a menu) rather than deep (many menu levels)?	O	O	O	
3.6	If the system has multiple menu levels, is there a mechanism that allows users to go back to previous menus?	O	O	O	
3.7	Can users move forward and backward between fields or dialog box options?	O	O	O	
3.8	Can users set their own system, session, file, and screen defaults?	O	O	O	

A.4. Consistency and Standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

#	Review Checklist	Yes	No	N/A	Comments
4.1	Has a heavy use of all uppercase letters on a screen been avoided?	O	O	O	
4.2	Are icons labeled?	O	O	O	
4.3	Does each window have a title?	O	O	O	
4.4	Is vertical and horizontal scrolling possible in each window?	O	O	O	
4.5	Does the menu structure match the task structure?	O	O	O	
4.6	Are menu choice lists presented vertically?	O	O	O	
4.7	Are menu titles either centered or left-justified?	O	O	O	
4.8	Are field labels consistent from one data entry screen to another?	O	O	O	
4.9	Are gaining attention techniques (intensity, size, font, color) used with care?	O	O	O	
4.10	Is the most important information placed at the beginning of the prompt?	O	O	O	
4.11	Are user actions named consistently across all prompts in the system?	O	O	O	
4.12	Are system objects named consistently across all prompts in the system?	O	O	O	
4.13	Is high-value, high-chrome colors used to attract attention?	O	O	O	

A.5. Error Prevention

Even better than good error messages is a careful design which prevents a problem from occurring in the first place.

#	Review Checklist	Yes	No	N/A	Comments
5.1	Are menu choices logical, distinctive, and mutually exclusive?	O	O	O	
5.2	If the system displays multiple windows, is navigation between windows simple and visible?	O	O	O	
5.3	Does the system prevent users from making errors whenever possible?	O	O	O	
5.4	Does the system warn users if they are about to make a potentially serious error?	O	O	O	
5.5	Do data entry screens and dialog boxes indicate the number of character spaces available in a field?	O	O	O	
5.6	Do fields in data entry screens and dialog boxes contain default values when appropriate?	O	O	O	

A.6. Recognition Rather Than Recall

Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

#	Review Checklist	Yes	No	N/A	Comments
6.1	For question and answer interfaces, are visual cues and white space used to distinguish questions, prompts, instructions, and user input?	O	O	O	
6.2	Are all data a user needs on display at each step in a transaction sequence?	O	O	O	
6.3	Are prompts, cues, and messages placed where the eye is likely to be looking on the screen?	O	O	O	
6.4	Have prompts been formatted using white space, justification, and visual cues for easy scanning?	O	O	O	
6.5	Is white space used to create symmetry and lead the eye in the appropriate direction?	O	O	O	
6.6	Is size, boldface, underlining, color, shading, or typography used to show relative quantity or importance of different screen items?	O	O	O	
6.7	Are borders used to identify meaningful groups?	O	O	O	
6.8	Has the same color been used to group related elements?	O	O	O	
6.9	Is color coding consistent throughout the system?	O	O	O	
6.10	Is there good color and brightness contrast between image and background colors?	O	O	O	
6.11	Have light, bright, saturated colors been used to emphasize data and have darker, duller, and desaturated colors been used to de-emphasize data?	O	O	O	
6.12	Is the first word of each menu choice the most important?	O	O	O	
6.13	Does the system provide *mapping:* that is, are the relationships between controls and actions apparent to the user?	O	O	O	

A.7. Flexibility and Efficiency of Use

Accelerators-unseen by the novice user-may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions. Provide alternative means of access and operation for users who differ from the "average" user (e.g., physical or cognitive ability, culture, language, etc.)

#	Review Checklist	Yes	No	N/A	Comments
7.1	Can users define their own synonyms for commands?	O	O	O	
7.2	Does the system provide function keys for high-frequency commands?	O	O	O	
7.3	If menu lists are short (seven items or fewer), can users select an item by moving the cursor?	O	O	O	
7.4	If the system uses a pointing device, do users have the option of either clicking on fields or using a keyboard shortcut?	O	O	O	
7.5	On data entry screens, do users have the option of either clicking directly on a field or using a keyboard shortcut?	O	O	O	
7.6	On menus, do users have the option of either clicking directly on a menu item or using a keyboard shortcut?	O	O	O	

A.8. Aesthetic and Minimalist Design

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

#	Review Checklist	Yes	No	N/A	Comments
8.1	Is only (and all) information essential to decision making displayed on the screen?	O	O	O	
8.2	Are all icons in a set visually and conceptually distinct?	O	O	O	
8.3	Does each icon stand out from its background?	O	O	O	
8.4	Are meaningful groups of items separated by white space?	O	O	O	
8.5	Does each data entry screen have a short, simple, clear, distinctive title?	O	O	O	
8.6	Are field labels brief, familiar, and descriptive?	O	O	O	
8.7	Are prompts expressed in the affirmative, and do they use the active voice?	O	O	O	
8.8	Is each lower-level menu choice associated with only one higher level menu?	O	O	O	
8.9	Are menu titles brief, yet long enough to communicate?	O	O	O	

A.9. Help Users Recognize, Diagnose, and Recover From Errors

Error messages should be expressed in plain language (NO CODES).

#	Review Checklist	Yes	No	N/A	Comments
9.1	Are prompts stated constructively, without overt or implied criticism of the user?	O	O	O	
9.2	Do prompts imply that the user is in control?	O	O	O	
9.3	Are prompts brief and unambiguous?	O	O	O	
9.4	Are error messages worded so that the system, not the user, takes the blame?	O	O	O	
9.5	Do all error messages in the system use consistent grammatical style, form, terminology, and abbreviations?	O	O	O	
9.6	Do messages place users in control of the system?	O	O	O	
9.7	Do error messages inform the user of the error's severity?	O	O	O	
9.8	Do error messages suggest the cause of the problem?	O	O	O	
9.9	Do error messages indicate what action the user needs to take to correct the error?	O	O	O	

A.10. Help and Documentation

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

#	Review Checklist	Yes	No	N/A	Comments
10.1	Do the instructions follow the sequence of user actions?	O	O	O	
10.2	If menu choices are ambiguous, does the system provide additional explanatory information when an item is selected?	O	O	O	
10.3	Is the help function visible; for example, a key labeled HELP or a special menu?	O	O	O	
10.4	Is the help system consistent with the interface of the application?	O	O	O	
10.5	Navigation: Is information easy to find?	O	O	O	
10.6	Presentation: Is the visual layout well designed?	O	O	O	
10.7	Conversation: Is the information accurate, complete, and understandable?	O	O	O	
10.8	Is there context-sensitive help?	O	O	O	
10.9	Is it easy to access and return from the help system?	O	O	O	

A.11. Skills

The system should support, extend, supplement, or enhance the user's skills, background knowledge, and expertise ---- not replace them.

#	Review Checklist	Yes	No	N/A	Comments
11.1	Are window operations easy to learn and use?	O	O	O	
11.2	Are users the initiators of actions rather than the responders?	O	O	O	
11.3	When the user enters a screen or dialog box, is the cursor already positioned in the field users are most likely to need?	O	O	O	
11.4	Can users move forward and backward within a field?	O	O	O	
11.5	Is the method for moving the cursor to the next or previous field both simple and visible?	O	O	O	
11.6	Do the selected input device(s) match user capabilities?	O	O	O	
11.7	Does the system correctly anticipate and prompt for the user's probable next activity?	O	O	O	

A.12. Pleasurable and Respectful Interaction with the User

The user's interactions with the system should enhance the quality of her or his work-life. The user should be treated with respect. The design should be aesthetically pleasing- with artistic as well as functional value.

#	Review Checklist	Yes	No	N/A	Comments
12.1	Is each individual icon a harmonious member of a family of icons?	O	O	O	
12.2	Has excessive detail in icon design been avoided?	O	O	O	
12.3	Has color been used with discretion?	O	O	O	
12.4	Has the amount of required window housekeeping been kept to a minimum?	O	O	O	
12.5	Has color been used specifically to draw attention, communicate organization, indicate status changes, and establish relationships?	O	O	O	
12.6	Is the organization of the system easy to follow?	O	O	O	
12.7	Does the system have all the functions and capabilities user expects from it?	O	O	O	

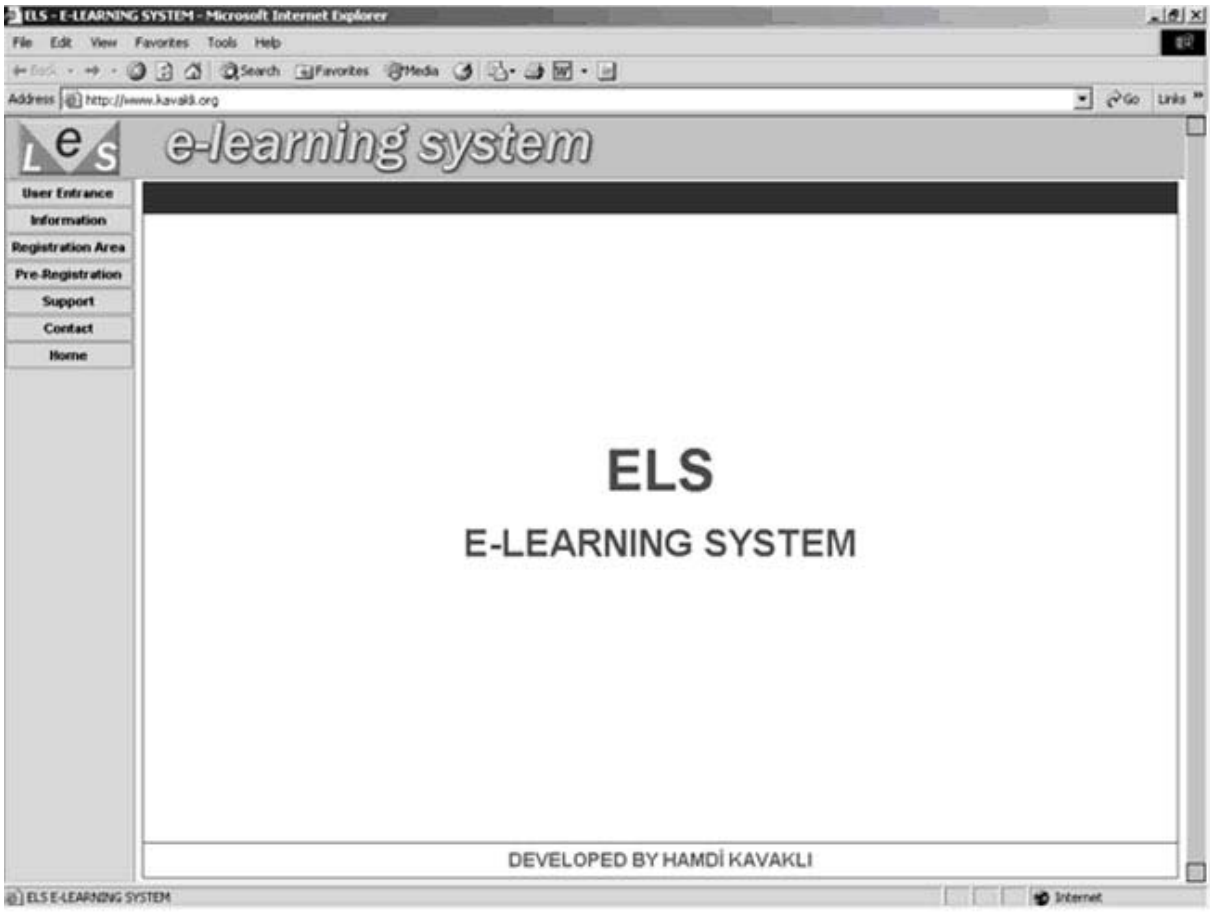
A.13. Privacy

The system should help the user to protect personal or private information- belonging to the user or the his/her clients.

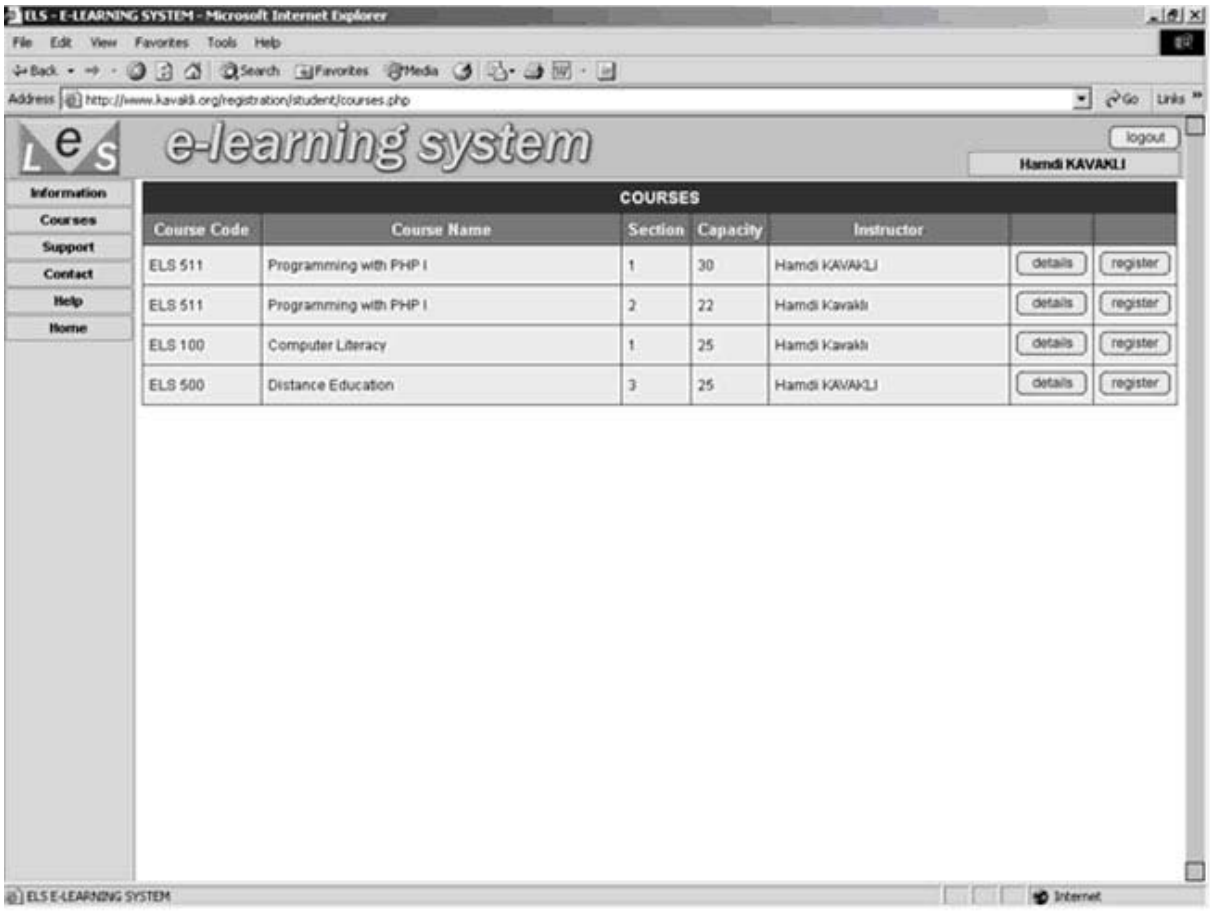
#	Review Checklist	Yes	No	N/A	Comments
13.1	Are protected areas completely inaccessible?	O	O	O	
13.2	Can protected or confidential areas be accessed with certain passwords?	O	O	O	
13.3	Is this feature effective and successful?	O	O	O	

APPENDIX B

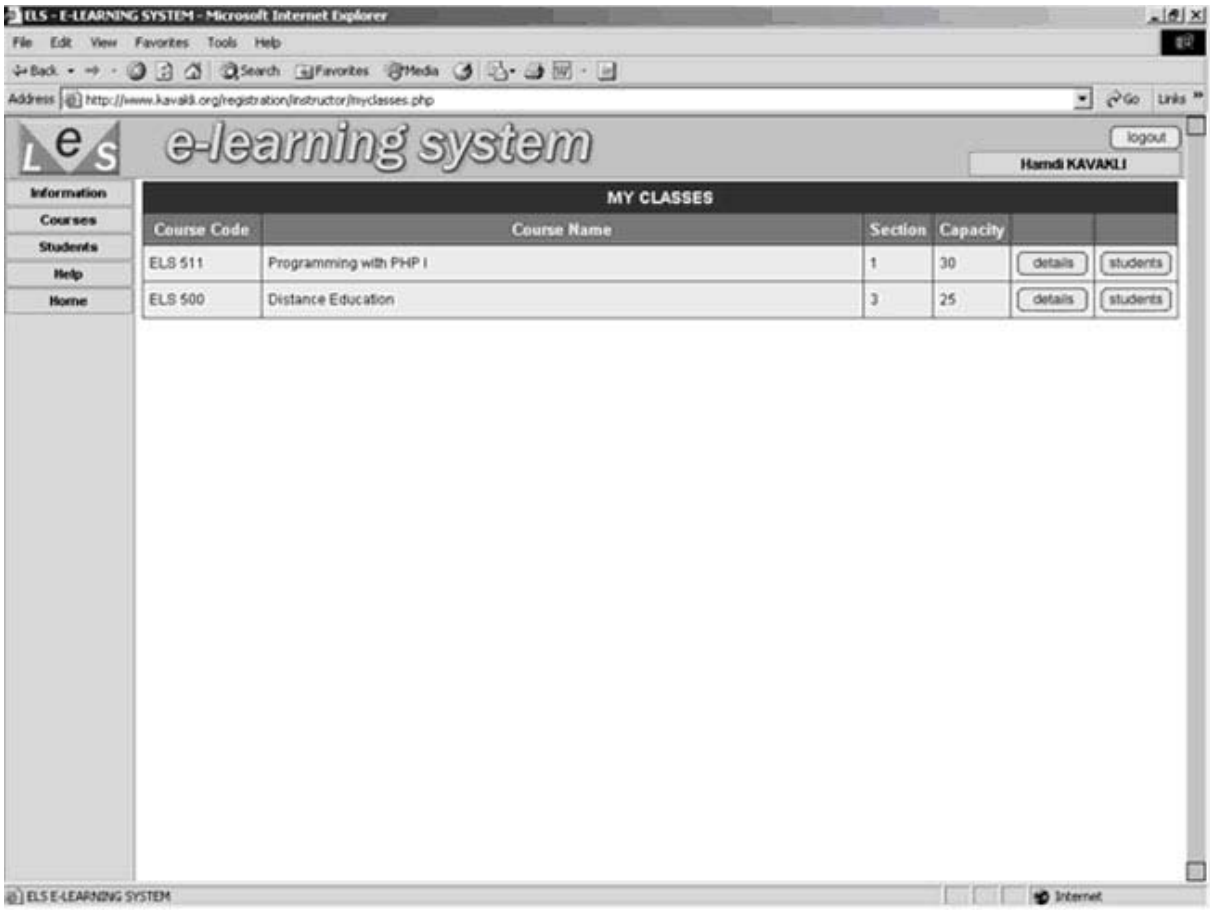
E-LEARNING SYSTEM SCREEN SHOTS



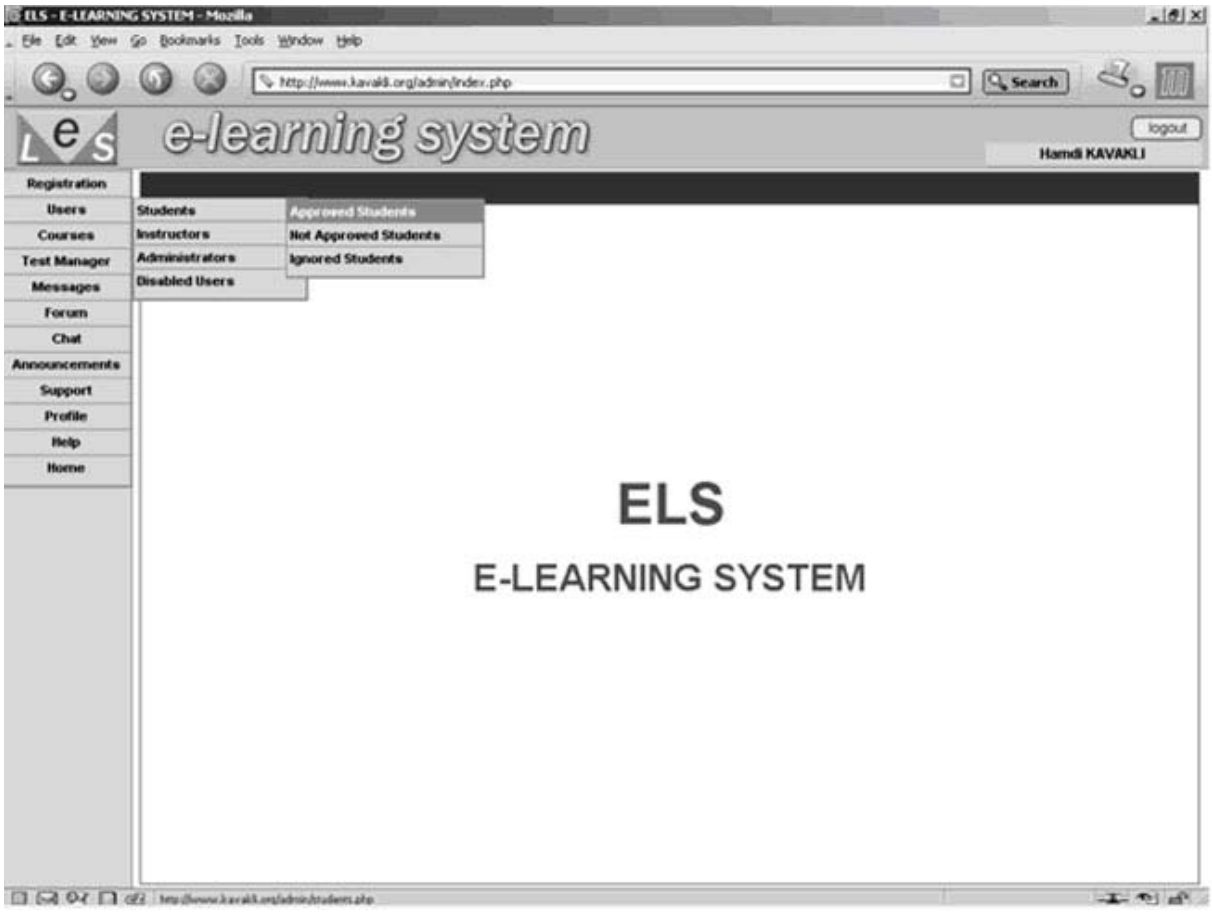
B.1 System Entrance



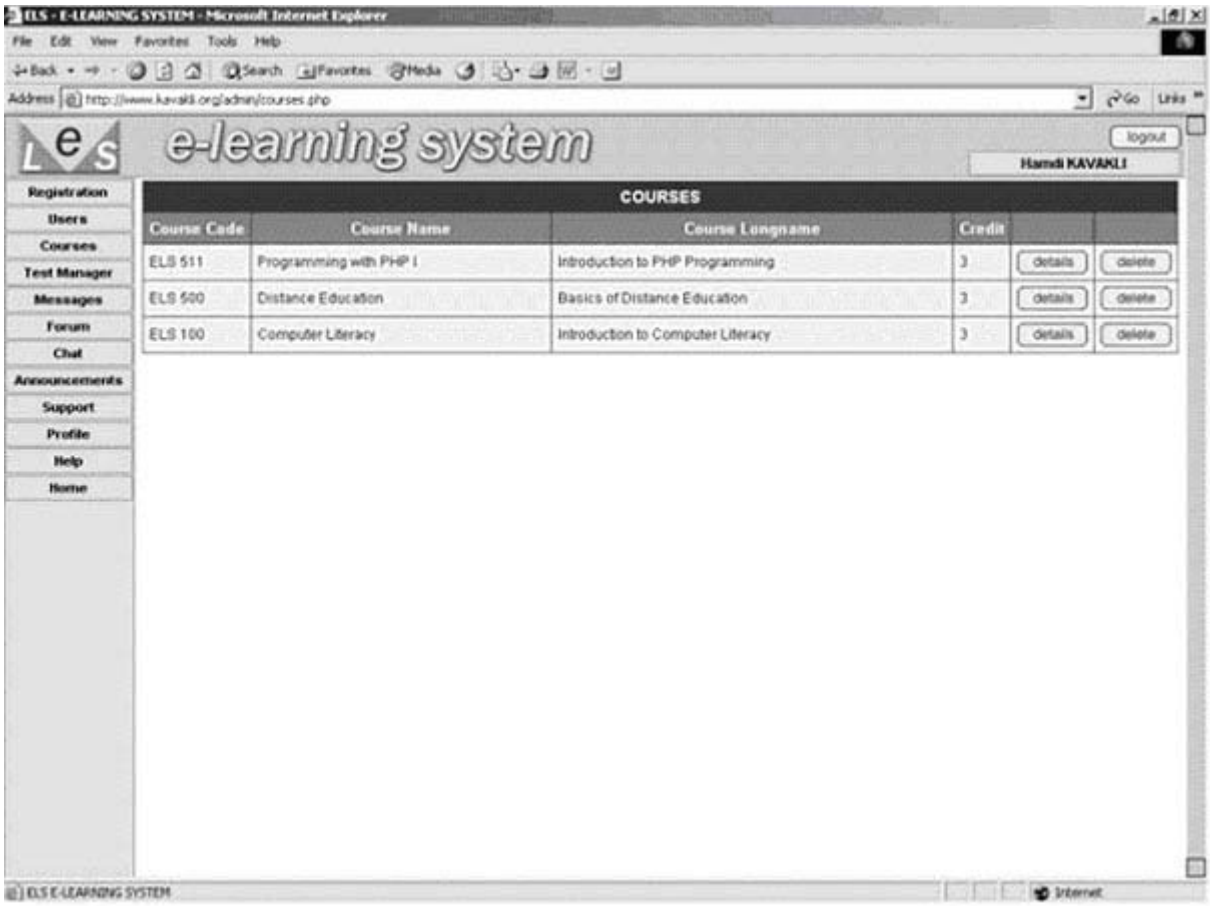
B.2 Registration Area for Students

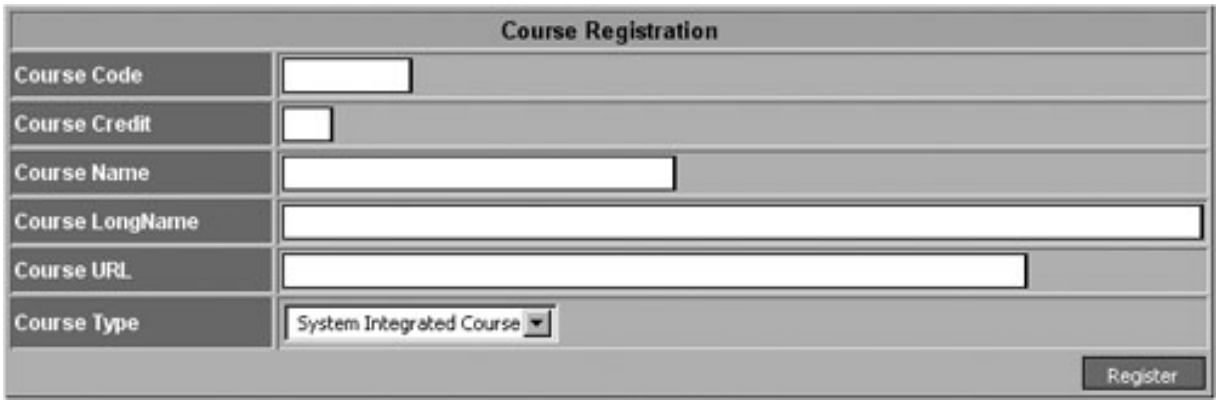


B.3 Registration Area for Instructors

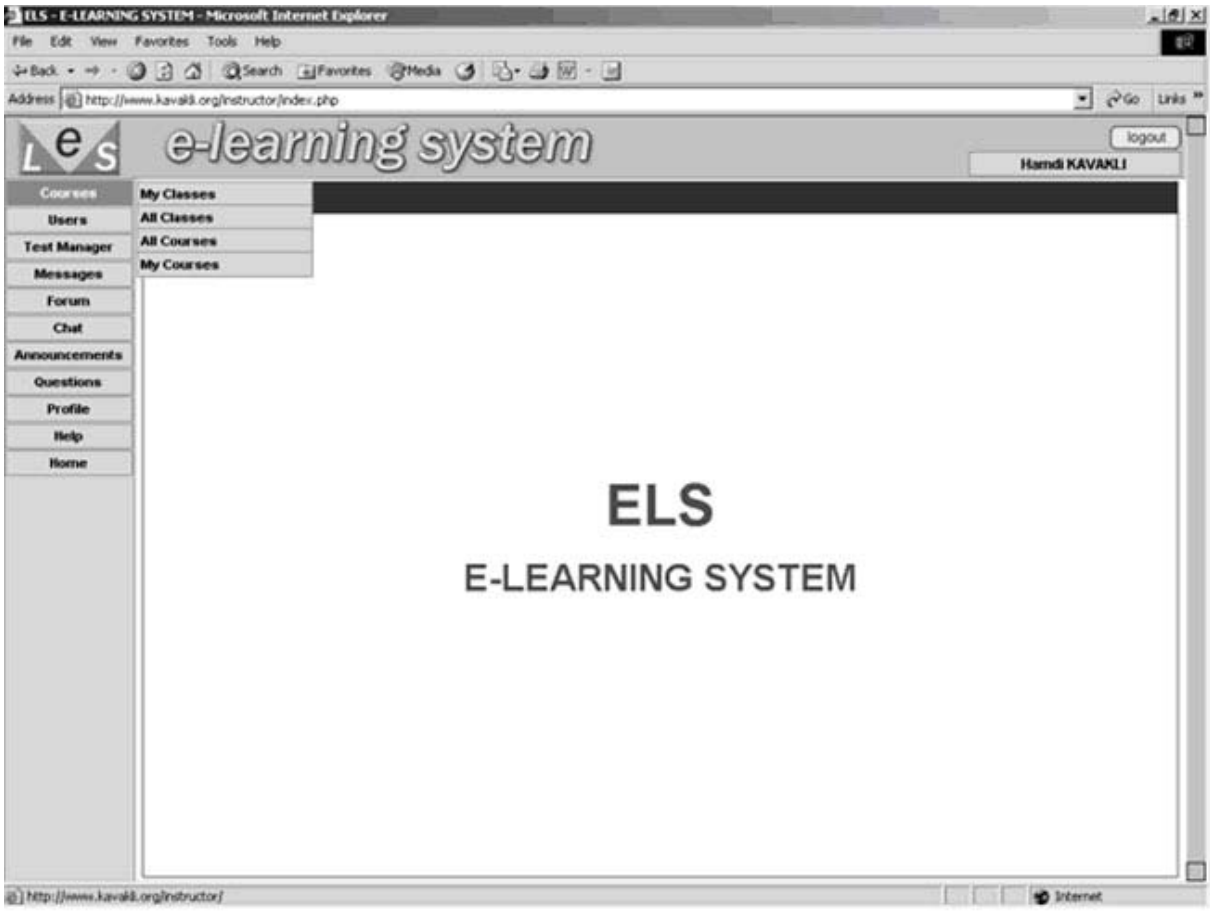


B.4 Administrator Area – Introduction Page

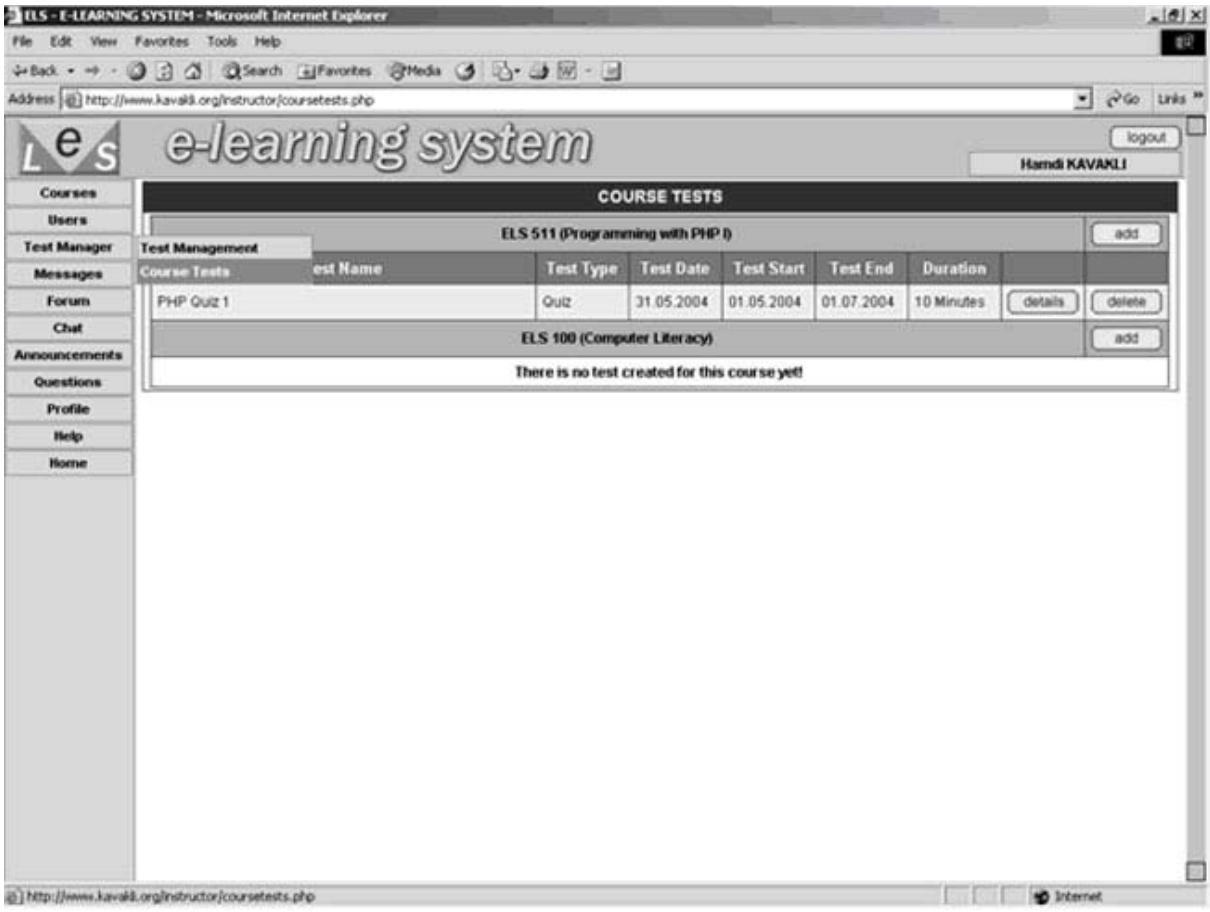




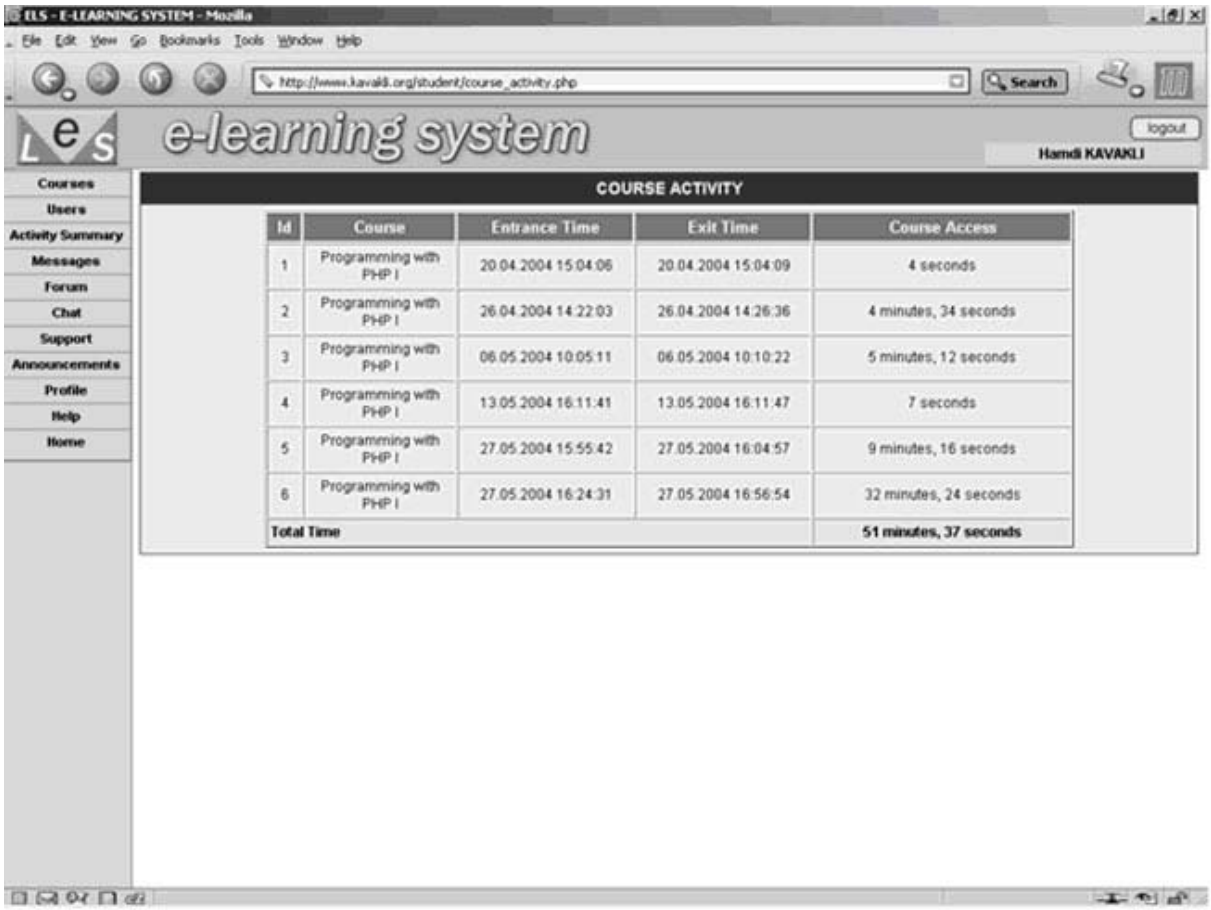
B.5 Administrator Area – Course List and Course Registration Form



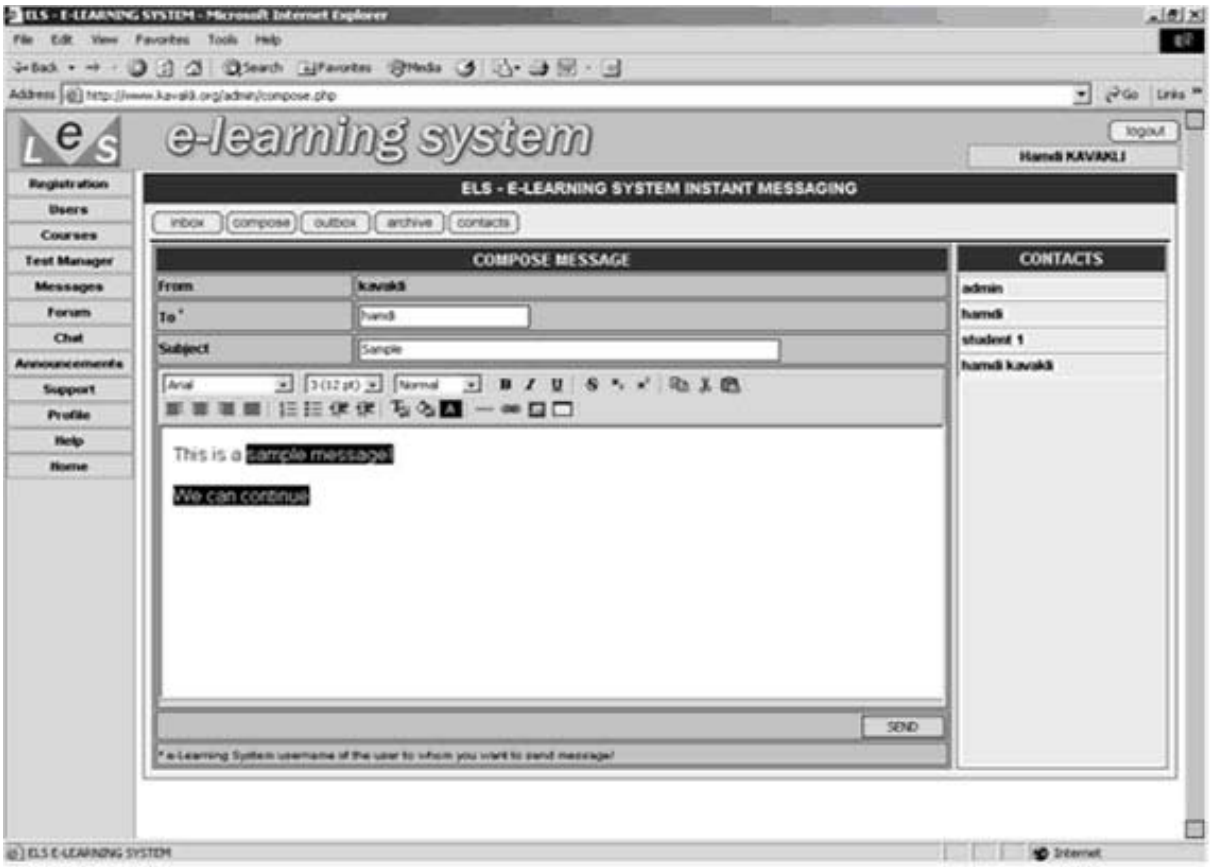
B.6 Instructor Area – Introduction Page

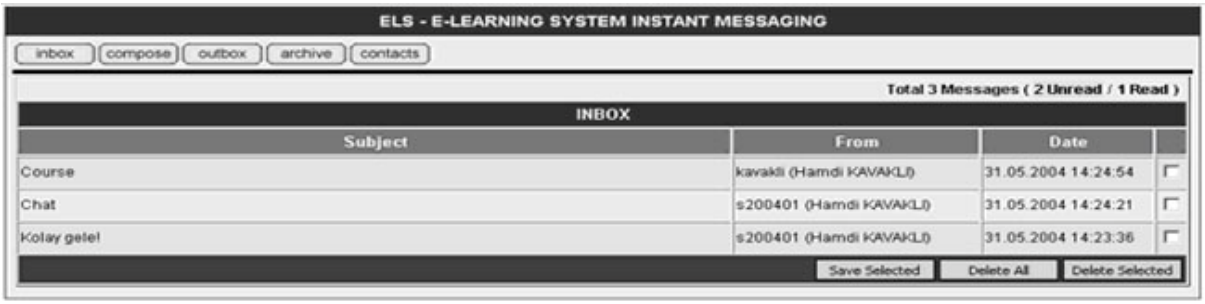


B.7 Instructor Area – List of Course Tests

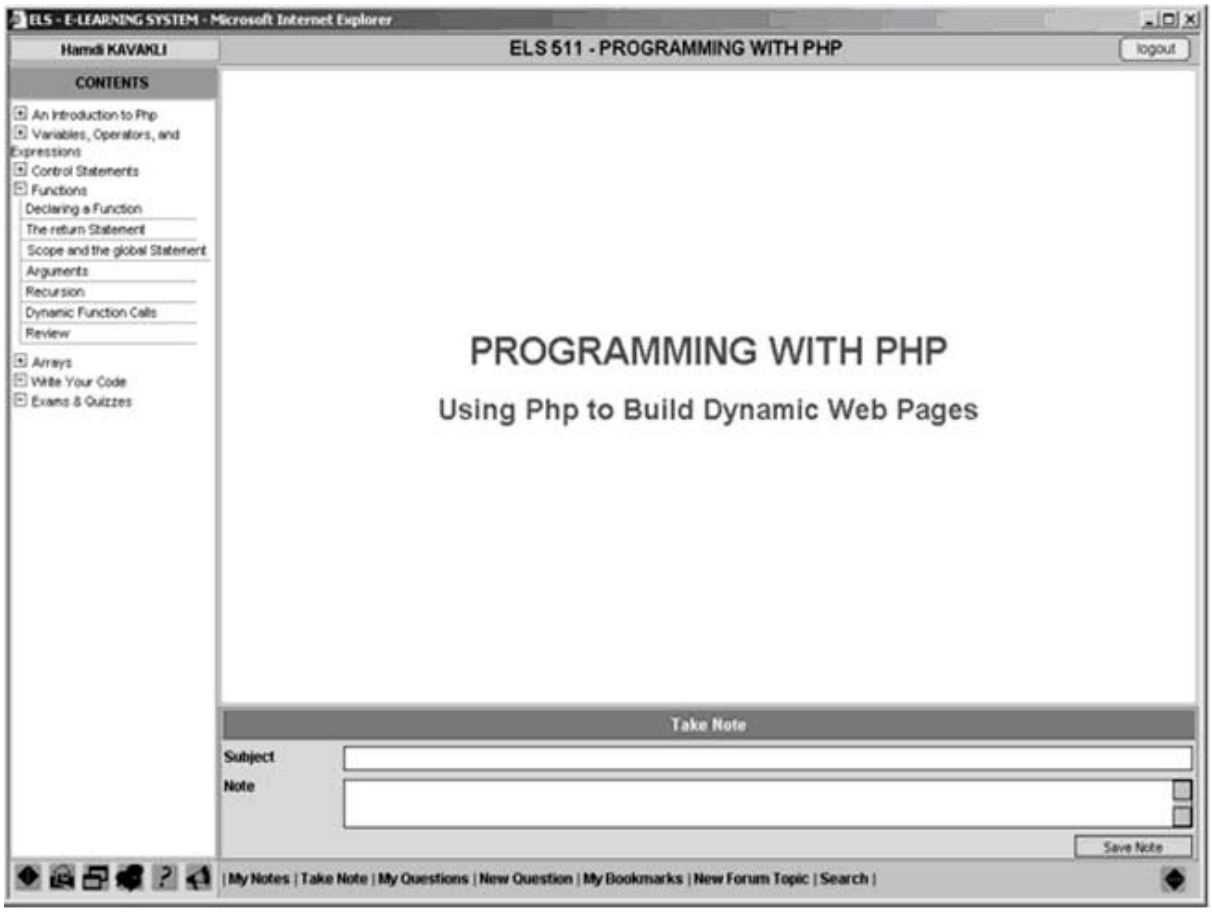


B.8 Student Area – Course Activity



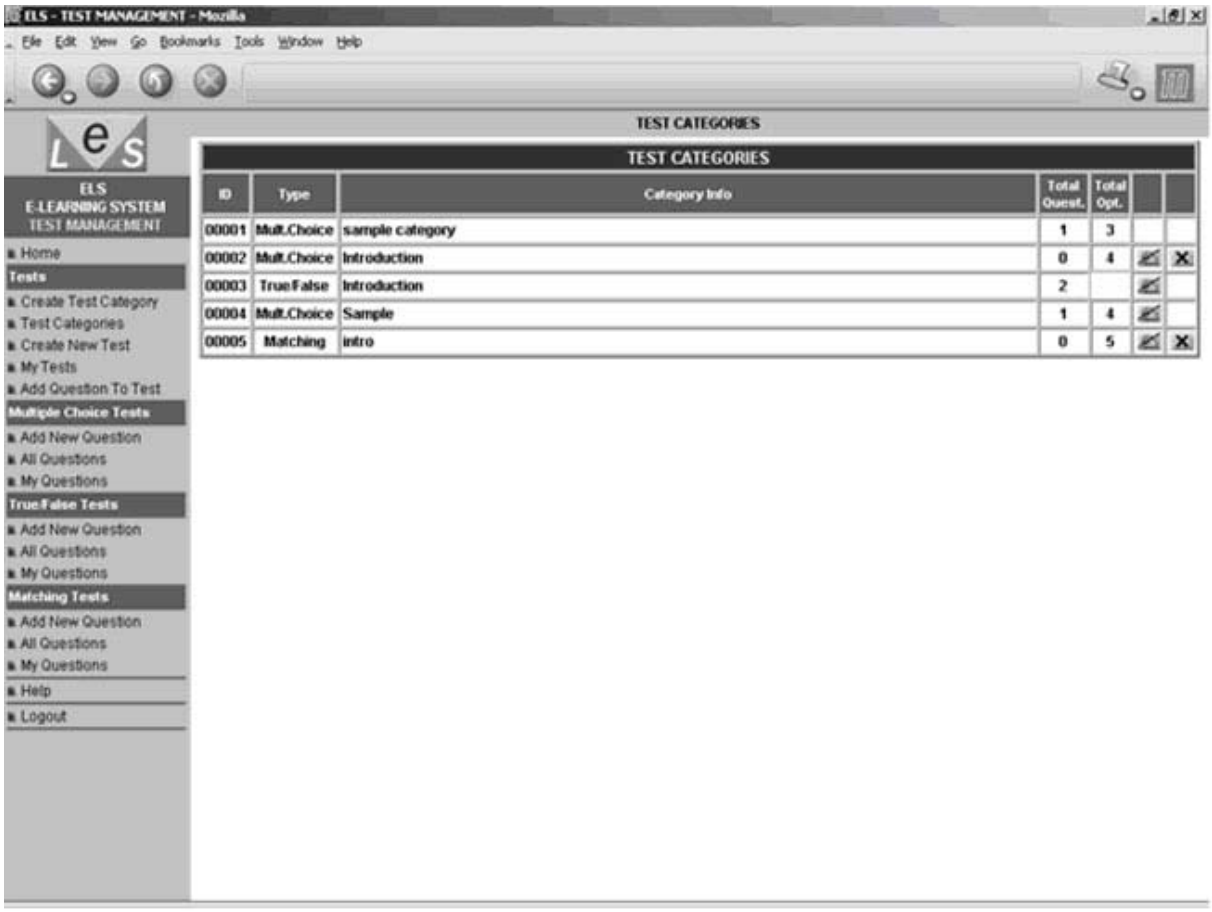


B.9 Messaging Module – Compose Form and Inbox

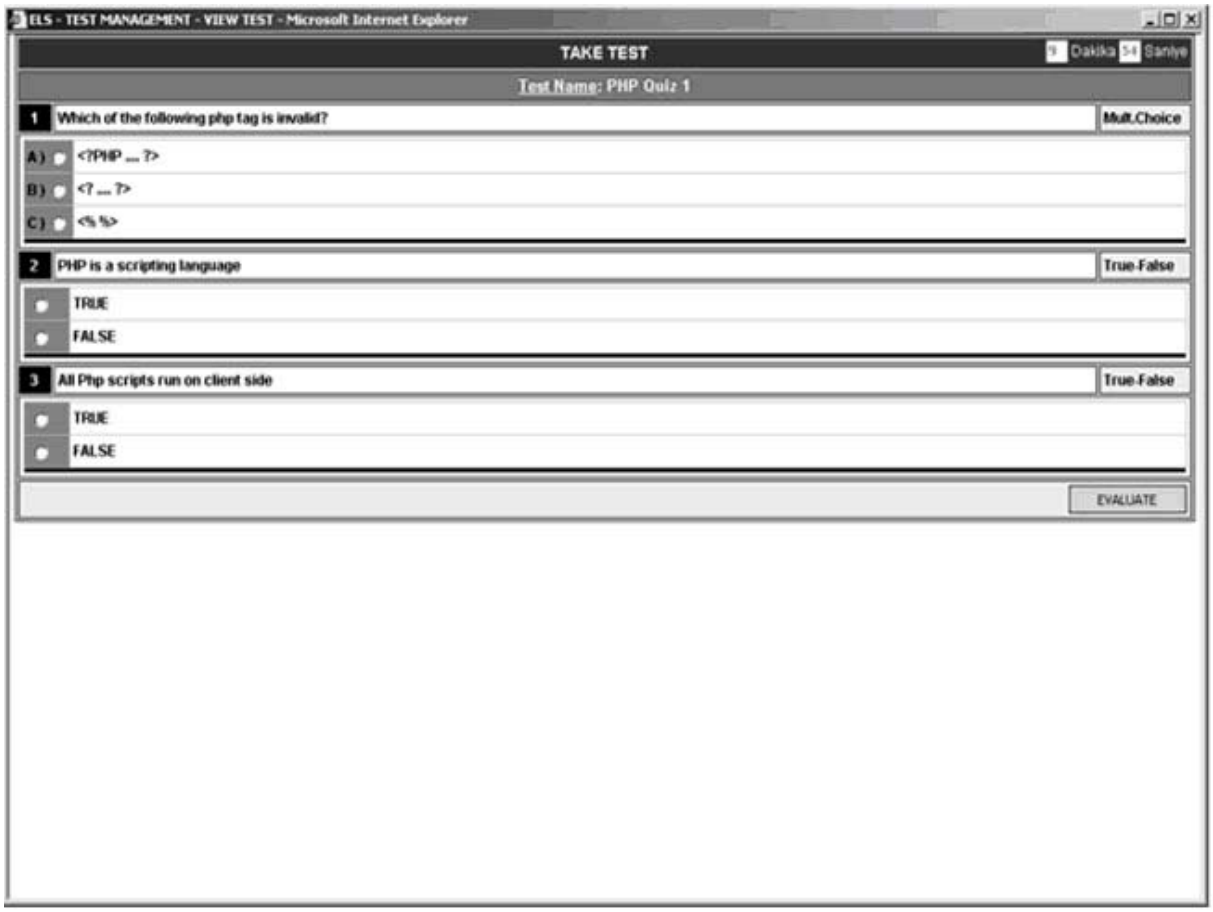


B.10 Course Module - Introduction

B.11 Course Module (Hidden Left and Bottom Panel) – Sample Course Page

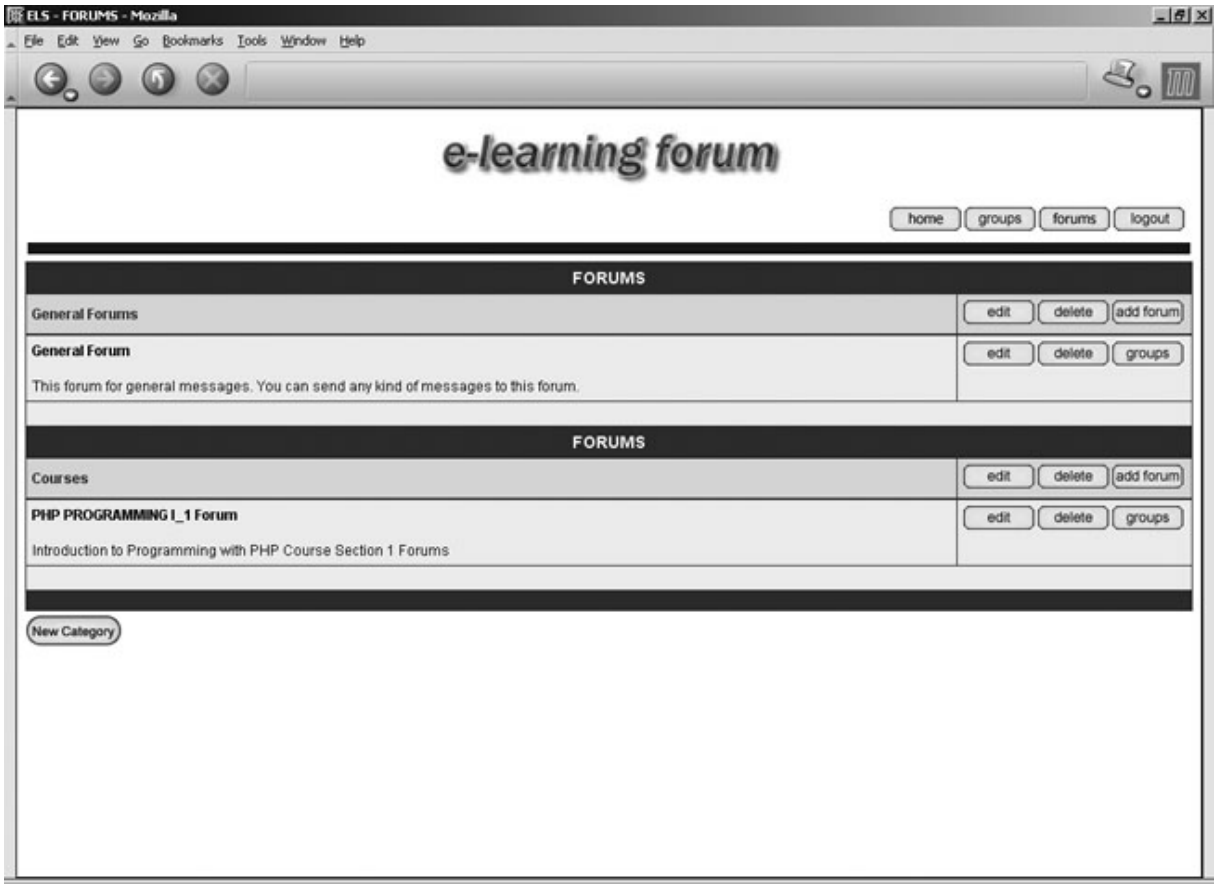


B.12 Test Management Module – List of Test Categories

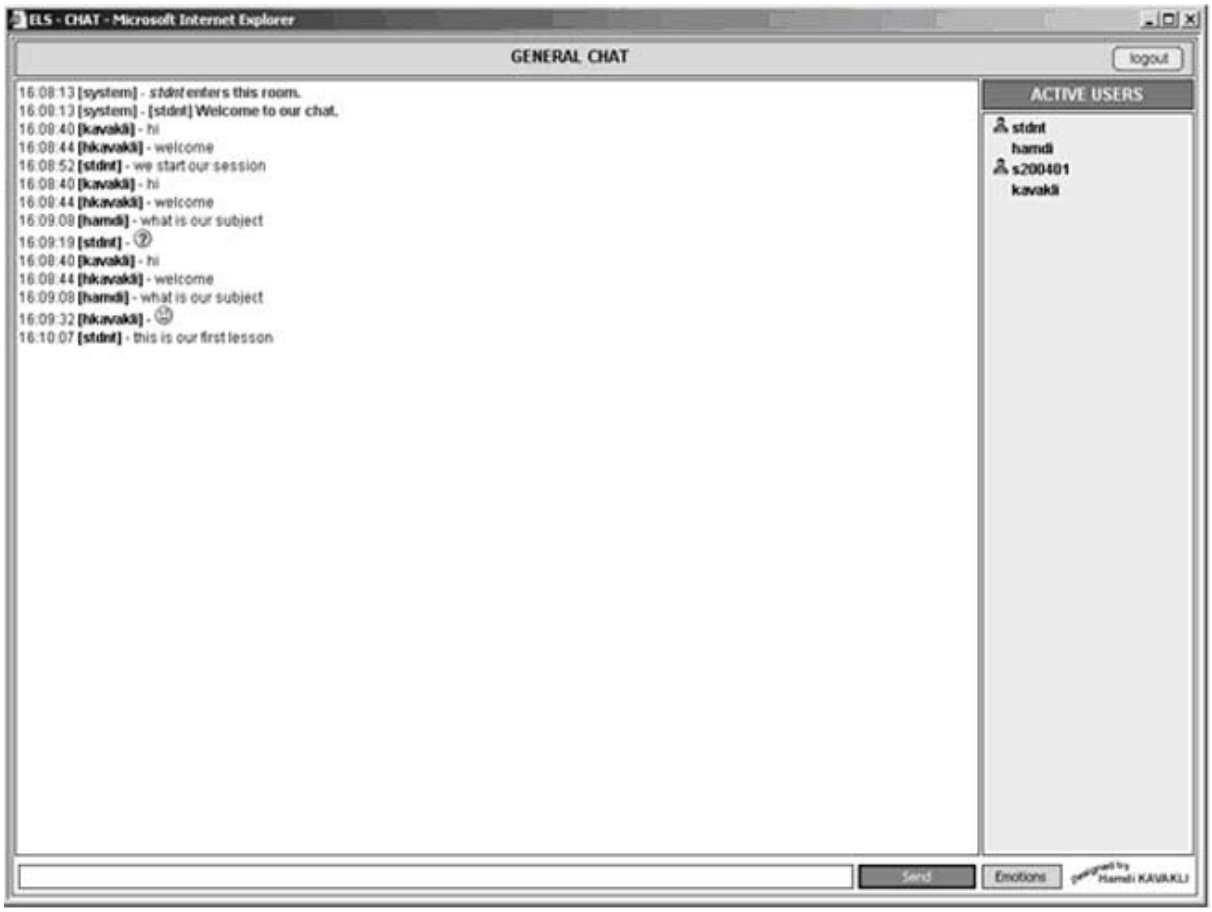


B.13 Test Management Module – Test Preview

B.14 ELS Forums - Introduction Page



B.15 ELS Forums – Forum Management



B.16 ELS Chat - Sample Chat Session