EFFECT OF CONSTRUCTED WEB-SUPPORTED INSTRUCTION ON ACHIEVEMENT RELATED TO EDUCATIONAL STATISTICS

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ABSTRACT

EFFECT OF CONSTRUCTED WEB-SUPPORTED INSTRUCTION ON ACHIEVEMENT RELATED TO EDUCATIONAL STATISTICS

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The purpose of this study is to investigate the effect of web supported statistics education environment for graduate level students. The aim was to develop a web support system to ease the graduate students' understanding of statistical concepts. This study also examined the perceptions of the students about web supported instruction.

Although there are some studies conducted about technology aided statistics education, they are insufficient in the amount according to other areas. Besides these few studies were conducted mainly among lower grades. There is a need to find out and overcome students' learning difficulties about statistical concepts in graduate levels. The intention of the study was to construct a web support system for traditionally offered Educational Statistics course in order to decrease both instructor and students efforts to communicate, present, reach and use the resources. The subjects of the study were 21 graduate students of Educational Statistics course offered. None of the subjects was offered an on-line course before.

The study used both quantitative and qualitative measurements to analyze the effectiveness of the site and perceptions of the users. The results of the study indicated that there was an improvement in students' achievement related to educational statistics through web supported instruction. Besides, the perceptions of the students were collected with interview questions about the functions and usability of the system. The highly positive perceptions of the students showed that, it is necessary for the students to have such a course support system.

The framework was developed not only support for traditionally offered courses, but also support for lifelong learning processes. The researcher believed that the study revealed the most realistic usage pattern of a course support system. The results can be used by the instructors in order to offer the best web support system with minimum effort. Moreover, the proposed system can be used in any learning content management systems without the need for technical knowledge.

KEYWORDS: Statistics Education, Learning Content Management System, Web Support System, Independent Learning, Web Aided Instruction

ÖZ

İNTERNET DESTEKLİ ÖĞRETİM ORTAMININ EĞİTİMDE İSTATİSTİK UYGULAMALARI KONUSUNDA ÖĞRENCİLERİN BAŞARILARI ÜZERİNDEKİ ETKİSİ

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Bu çalışma hazırlanmış olan internet destekli öğretim ortamının lisansüstü öğrenciler için istatistik öğrenimi üzerindeki etkisini incelemektedir. Amaç öğrencilerin istatistik ile ilgili kavramları öğrenmelerini kolaylaştıracak bir öğretim ortamı hazırlamaktır. Çalışmanın bir başka boyutu, öğrencilerin internet destekli eğitim ile ilgili algılarını incelemektir.

Teknoloji destekli istatistik eğitimi konusunda bazı çalışmalar olmasına rağmen, konunun önemine göre sayıca az kalmaktadır. Bu çalışmalar daha çok ortaöğretim düzeyinde kalmaktadır. Çalışmanın hedefi geleneksel öğretim ile işlenen Eğitimde İstatistik Uygulamaları dersi için bir internet destekli öğretim ortamı oluşturarak hem akademisyenlerin materyal sağlama, hem de öğrencilerin, materyallere erişme, kullanma ve tüm kullanıcıların iletişim güçlüklerini ortadan kaldırmaktır. Eğitimde İstatistik Uygulamaları dersine devam eden 21 yüksek lisans öğrencisi çalışmanın örneklemi olarak seçilmiştir. Katılımcılardan hiç biri daha önce çevirim içi bir derse devam etmemiştir.

Destek sisteminin etkisi ve kullanıcıların algılarını belirlemek için hem nicel hem de nitel ölçme teknikleri kullanılmıştır. Çalışma sonucu nicel anlamda destek sisteminin başarıyı olumlu etkilediği gözlenmiştir. Bunun yanında sistemin özellikleri ve kullanışlılığıyla ilgili sorularla bireysel görüşmelerde, öğrencilerin sistem ile ilgili olumlu görüşleri olduğu belirlenmiştir. Nitel bulgular da böyle bir destek sisteminin gerekli olduğu yönündedir.

Ders destek sistemi sadece geleneksel yolla öğretime destek amacıyla değil, aynı zamanda hayat boyu öğrenme sürecinde kişilere bireysel anlamda destek olacak şekilde tasarlanmıştır. Araştırmacı çalışmanın ders destek sistemleri için bugüne kadarki en gerçekçi kullanım şablonunu ortaya çıkardığını düşünmektedir. Akademisyenler çalışma sonuçlarını ve hazırlanmış sistemi en az uğraşla ve en pratik şekilde kendi ders destek sistemlerini oluşturmakta kullanabileceklerdir. Bunun yanında sistem tüm öğrenme yönetim sistemleri içine bütünleştirilerek ilgili tüm kişi ve kurumlar tarafından da teknik bilgi gerekmeksizin kullanılabilecek durumdadır.

ANAHTAR KELİMELER: İstatistik Eğitimi, Öğrenme İçerik Yönetim Sistemi, İnternet Destekli Öğretim Ortamı, Bağımsız Öğrenme, İnternet Destekli Eğitim

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CHAPTER 1

INTRODUCTION

"No age for learning" is not an appropriate phrase for defining the situation for the education any more. Ignoring the impact of the technology on many aspects of our lives is not possible anymore. Especially with the increased use of the internet "No age, no place, no time for learning" is more appropriate than the aforementioned phrase for defining the current approach.

Now the approach has a name as ubiquitous learning. This is an important concept and its importance will increase in the future. The name can vary but the situation remains the same. The importance comes from the variety of resources to use in order to improve the quality of education. The point is these resources should be used either in the positive or in the negative ways. For example the internet can be used either to get educational benefits or as an obstacle for the learner to study. This situation will lead to an indispensable usage of these types of resources for educational improvements. The researchers should provide better learning environments which can be used easily for the learners. This study was conducted in order to prepare an easy to use learning environment for both instructors and students. The subject was selected as educational statistics.

A ubiquitous learning environment is a situation or setting of pervasive or omnipresent learning. Education is happening all around the student

but the student may not even be conscious of the learning process. Source data is present in the embedded objects and students do not have to do anything in order to learn. They just have to be there.

The main characteristics of ubiquitous learning are shown as follows (Ogata & Yano, 2004):

- Permanency: Learners can never lose their work unless it is deleted purposefully. In addition, all the learning processes are recorded continuously in everyday.
- Accessibility: Learners have access to their documents, data, or videos from anywhere. That information is provided based on their requests. Therefore, the learning involved is self-directed.
- Immediacy: Wherever learners are, they can get any information immediately. Therefore learners can solve problems quickly. Otherwise, the learner may record the questions and look for the answer later.
- Interactivity: Learners can interact with experts, teachers, or peers in the form of synchronies or asynchronous communication. Hence, the experts are more reachable and the knowledge is more available.
- Situating of instructional activities: The learning could be embedded in our daily life. The problems encountered as well as the knowledge required are all presented in the nature and authentic forms. It helps learners notice the features of problem situations that make particular actions relevant.
- Adaptability: Learners can get the right information at the right place with the right way.

Usage of learning content management systems which will be explained in detail is a way of providing ubiquitous learning environment for the learners. The aforementioned characteristics are provided by the learning content management systems. Provided course support framework in this study may ease the creation of such environment.

As it is necessary to use technology in education, especially for the courses needs high effort to accomplish the objectives, technological aid becomes unavoidable. This technological aid is web supported instruction. Web supported instruction is the term used instead of web based instruction by the researcher because some readers may misunderstand the mean as completely offering courses over the internet. Web-based instruction (will mention as web supported instruction) definition made by Khan (1997) is:

> "...a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported."

Web supported instruction is using advantages of the Internet technology in order to improve the quality of the instruction. Computer based instruction is another term for technology support in education. Computer based instruction is using mainly computers instead of the internet. In this study, the researcher prepared a web support system for the educational statistics courses for the graduate level.

Support system could be prepared in various ways. Videos in CD-ROM could be prepared and delivered to the students. A prepared computer program could be implemented in the computer laboratory. But the researcher preferred a web supported system. By this way, students can reach and use the necessary information anytime and anywhere. These systems are named as Learning Management System (LMS) or Learning Content Management System (LCMS). Although they can be used interchangeably, there is a difference between LMS and LCMS according to Horton as cited by Hancı (2007). LMS is the system that is used for offering online courses. However LCMS is the system to support in class courses with online materials. Besides, Robbins (2002) tried to explain the difference of LMS and LCMS. The paper treats the

LCMS as a more talented version of LMS. This means the paper claims that LCMS can be used instead of LMS and it is capable to do more. For this reason the infrastructure of the prepared system is called as LCMS.

There are many LCMS alternatives that can be used. They can be categorized into two. Open source and not open source. Open source means the code of the software can be analyzed changed or improved. It is not possible even analyzing for not open source software. This means that the improvements of the software can only be made by the vendor. Open source ones can be improved by anyone. Not all but generally open source software is free of charge. Open Source Initiative was defined the open source as;

> "Open source is a development method for software that harnesses the power of distributed peer review and transparency of process. The promise of open source is better quality, higher reliability, more flexibility, lower cost, and an end to predatory vendor lock-in." (Open Source Initiative, 2007)

Especially the low cost of ownership is important for our situation. In Türkiye national income per person is not as higher as other developed countries. This means that the low cost is important for the institutions, instructors and even for the learners. Institutions should not invest much money on the system. Instructors and learners should not need to change the technological devices in order to use the system.

In fact the case is not so different for developed countries. Open University is the biggest distance education institution in the world. The institution was being used a commercial and not open sourced LCMS. But they decided to start using open source freely available LCMS (Open University chooses Moodle!, 2005).

As defined before LCMS is the system to support in class courses with online materials. The system will have internal applications such as

communication forum, chat, chapter summaries, practice questions, useful links, and organized interactive applications. Open sourced and freely available ATutor Open Source Content Learning Management System will be used as the framework for the support system. The system is being used by the researcher in various courses. It includes a wide variety of tools to prepare a supportive learning environment. By being free and open-source, it is open for rapid development and more feasible for our country according to commercial systems. It requires lower system requirements among the alternatives both for the server side and client side.

There is another popular and widely used open source and freely available LCMS; Moodle. There is no restriction of Moodle usage for technology support; in fact ATutor can export the content with Scorm compliant. So any instructor can change the framework to Moodle if he/she wants. The researcher compared the LCMS alternatives and decided to use ATutor as the framework like Lengyel, Herdon, and Szilagyi (2006). The researcher offers usage of ATutor as a web support system for education if the instructor will use and manage LCMS for the first time. The Netclass system offered in METU, which is not open source and freely available, is not considered in this case, because the course instructor is not able to manage the Netclass system.

These are not only LCMS alternatives. There are many open source LMS projects. Aberdour (2007) listed active projects in his paper. The list is given in Table 1.1.

Table 1.1: Active Open Source LMS Projects

a-LMS	Interact
AnaXagora	JLI!
Answers	KEWL
ATutor	KEWL.NextGen
Avatal Learn Station	LogiCampus
AvieOnline	LON-CAPA
Bazaar	Maestra
Bodington	Manhattan
Brihaspati	metacoon
Claroline	Moodle
CommSy	OLAT
COSE	Open Elms
CourseWork	Open Learning Repository
Didactor	Open Learning System
Docebo	OpenLMS
Dokeos	OSLearning
dotLRN	Papermark
DotNetSCORM	Sakai
DrupalEd	Segue
EIFFE-L	Shishya
Eledge	The Rock LMS
eStudy	Tiny LMS
ForeL	Uni Open Platform
Helo	Virtucoll
Ilias	

As it can be seen, there are many free and open source LCMS alternatives. In this study a course support framework was prepared by using one of these software as the base point. The prepared system can be used in almost all of those systems. The system was prepared as a support system for traditional courses. Besides, the system can be used not only by the students, but also by the people needs further information. So the study can also be considered as a ubiquitous learning environment, as it is a support for lifelong learning.

Researcher believes that the web support framework for the traditionally offered courses will be helpful for the educational area in the following topics:

- Instructor will not have to prepare the course materials again for each semester. The materials could be used with small changes repeatedly.
- The system will ease and decrease the effort of the instructors who want to have web support for their courses.
- Students will have opportunity to reach the course materials from everywhere and also will be able to practice and study other than the lecture hours.
- Intended learners will have the opportunity to learn or remember the required information whenever they want. In fact, the system will support the lifelong learning process.
- The support system can be used for the distance education purposes with some additions and changes on the materials.

CHAPTER 2

REVIEW OF LITERATURE

It is important to consider the related literature about the study. This review reveals the needs and obstacles better in the field. By means of the previous studies the research can be better organized and reach to more accurate results.

The literature review starts with the analysis of interaction for the computer aided studies. Interaction is one of the most important concepts for technology related studies. Without interaction it is very difficult to have a useful medium in the field.

Then online education is analyzed. Online education is one of the most popular concepts among the relatively newer study fields. However, directly starting to use online education from the traditional education has a potential to bring more problems to the education area.

This study can be considered as web supported instruction as it offers a support medium to the traditionally offered course.

PART I

Interaction

The popularity of the internet becomes its offering interaction for users. Garrison and Anderson (2003) mentioned about several authors i.e. Laurillard, Garrison and Shale, Palloff and Pratt, and Patsula stated the importance of interaction in education. They are defining education including distance education as an interactive process. Interactivity is the most important part of the technology usage in education. Although the face to face education is considered as the most effective types of education, the lack of interactivity increases the popularity of technology support as well as time and place restriction.

Another study made by Brannan, as cited in Ersoy (2003) found that learner-learner, learner-teacher, learner-content and learner-technology interactions impacted favorably by the use of technology. İnan (2003) cited the idea of Pan who stated that hypermedia-based applications could provide a highly interactive learning environment where students build up their own knowledge. The prepared web support system in this study also provides all of these interactions.

As an important part of processing knowledge, interaction must be integrated into education as much as possible. Especially for the supportive materials to the instruction that are used outside of the classroom, the importance of the interaction increases. The internet may be the medium that provides the interaction that the supportive materials need.

Online (Web-Based) Education

Especially for the disabled or remotely settled learners online education becomes the best alternative. Ward and Newlands identified six perceived advantages of online courses (1998):

- Better learning resources
- A more flexible pace of learning
- Greater choice of when to study
- Increased self reliance
- More tutorials/seminars
- Improved computer literacy

On the other hand, in the same paper some disadvantages also stated as:

- Poorer learning resources
- An alienating learning experience
- Technical frustrations
- Inadequate access to computers
- Unfairness
- Loss of contact with staff
- Loss of contact with other students
- Reduced motivation

In another study by Beasley and Smyth (2004) the expected and actual student use of an online learning environment were analyzed considering the results in many papers like Ward and Newlands. As a result of this analysis it can be said that there is much difference between expected and actual benefits of online learning environment for the students' perspective. So it is very important to analyze the pros and cons of online instruction while deciding to be used. Moreover the preparation phase should be carefully planned.

Kuhlmann (2008) summarized the mistakes during the preparation of online courses with six topics:

- Preparing screen after screen of information irrelevant to the learner's needs. A more engaging approach is to drop them into

real-world situations where they have to make decisions that require the use of the course's information.

- Relying too much on their own intuition or experiences and end up building courses that don't fit the learner's needs. This is especially common among the subject matter experts.
- Creating a big course that the learner cannot accomplish to the end. They didn't need what was built. Courses must be kept simple and give them what they need when they need it.
- One of the biggest disconnects with e-learning is that instructors tend to use it to replace the time a person needs to learn from others in a social context. Sometime people don't need training. Instead they just need to be connected to others.
- The learners may have technological limitations, physical disabilities, or a work environment that's not conducive to taking e-learning courses.
- Miscalculation the motivations of the learner. While some people enjoy the e-learning courses, odds are that the learners are not quite as enthused. A good starting point is to focus on performance and helping them to do something better.

Lonie and Andrews (2008) analyzed the 9 students from the remote areas during the "Introduction to Monitoring for Management" and "Getting into Further Study" courses which were online. Virtual classroom environment was used to offer these courses. At the end of the study they concluded that, if the facilitator is technically and pedagogically prepared for the virtual classroom platform, this learning approach can realistically provide an active and collaborative learning experience for geographically remote students. In the paper there is important information about the infrastructure. Not only the facilitator but also the technical infrastructure should be prepared carefully. Paper says that the internet connection speed was at least 560/128 mbit/s for each student. This information is important because in Türkiye it is not possible to have such connections even in the institutions.

In the library of the Georgia State University employees were trained by using the WebCT CMS of the university about the new technologies being used. Employees appreciated the convenience and efficiency of online training opportunities. In fact, by this method they easily could keep their skills and knowledge current (Jones, 2009).

Wynegar and Fenster (2009) conducted an experimental research with 60 students during the College Algebra course. They compared four methodologies; traditional, computer aided instruction, online instruction, and television. Students who were instructed traditionally got the higher grade point average and one of the lowest failing rates. However, students' opinions about computer aided instruction were higher than traditional instruction. Another important point stated in by the authors was; institutions of higher education can deliver instruction more cost effective per student using traditional lecture.

Online courses can be the best alternative in some cases but some background information leads us to think about offering completely online courses. In Türkiye educational usage of technology and internet are not high, respective to the other developed countries. So the researcher decided to provide online support for a traditionally offered course. By this way it would be possible to benefit from the advantages of both online and in class courses. Besides, the results can be used as an indicator for the readiness for the completely online courses.

Internet as a Support for Education (Web-Supported Instruction)

Turkish people quickly get used to deal with the new technology. At the end of the 2007 there were over 5 million ADSL subscribers (turk.internet.com, 2008). Türkiye has the most increase in the ADSL subscriber number over the Europe. This means that the access to the internet has rapidly increasing. However, the educational content is not

increasing this fast. This will lead to the users to use the internet for non-educational purposes such as chat, games etc. It may be difficult to start to use technology directly for online education. As mentioned before it would be better to have technology support firstly for traditional courses. After that the need for online education may increase. Then improving the support systems there can be a slight transition to online courses in some areas.

Arslan (2009) conducted an experimental research among 7th grade 50 students about their attitudes towards Turkish Lesson course offered with computer aided instruction. As a result of the study it was seen that Turkish instruction in support of computer affected the students' attitudes towards Turkish lesson positively.

During the Trends in Information Industry and Society Nakayama, Kanazawa, and Yamamoto (2009) analyzed access log data of the course support system for 81 freshman undergraduate students. In the study both access log data for online modules and access log for taking part in online tests were analyzed. The study showed that there was a significant difference in final examination grades according to the usage data of support system. Besides the authors concluded that, the number of accesses can be an index for learning level of the students.

Witt (2003), who studied the effectiveness of web sites associated with traditional courses involving regular student attendance at university, concluded that most instructors are largely achieved their expectation from their prepared web sites for their course. Additionally, he examined the time spent by the instructor to create and maintain their sites. Results showed 13,6 hours as the mean of spent time to construct the site and 10,6 hours as to maintain the site. Time to construct the site was as long as 100 hours for some instructor and it was 50 hours to maintain the site. This means that it is still difficult for the instructors to prepare their own online course support materials. It

is necessary to ease the efforts of the instructors for this purpose. The idea is to prepare a framework for the instructors that they can easily implement for their own courses.

Sanders & Morrison-Shetlar (2001) have supported the traditional instruction by web technologies and they tried to find out the attitudes of the learners towards this new system. For the web component, the goal was to allow asynchronous learning outside the classroom and increase learner-to-learner interaction. Learners also used the web site to access chapter outlines, quizzes, and questions leading to improve critical-thinking and problem-solving skills, grades and the course syllabus. Reporting the web components' highly positive effect on student learning, critical-thinking and problem-solving skills, and the researchers suggested the following:

> "… Instructors should use the Web for the posting of course syllabi, grades, quizzes, questions, and materials that encourage student-to-student and student-to-faculty interaction."

Gillham, Buckner and Butt (1999) studied the usage and attitudes of 38 arts course students who were not enthusiastic to computers towards the Narrative and Genre (NAR) communication module at Queen Margaret University in UK. The module was tracking the students' usage time. 34 students used the site whereas 4 students did not. The average times of short, typical and long visits were 11, 21 and 43 minutes respectively. Time is quite high for the students who are not familiar with computers. 55% of students thought that the site had assisted a lot to their study while 45% thought a little. 52% perceived the site as useful, whereas 39% as essential and 9% as of limited use. 90% of students liked lectures and seminars supported by online materials, while 10% were not sure. None of the students disliked the idea of online support materials. The authors concluded that if the site was being updated more it would be used even more. But they

considered the site highly successful in introducing students to Web-based educational material.

Vogel & Klassen (2001) examined the FaBWeb at the City University of Hong Kong which is an educational environment that combines three individual software packages; Learning Resource, Meeting Space and Plat to Learn. Learning Resource part includes documentations, videos, presentations and links. Meeting space was used for communication among students and instructor based on scheduled programs and events. Play to Learn part contains interactive business games and simulations. But they consider the currently available web applications as tending to be very fragmented i.e. they include a number of non-integrated pieces and not interacting with other pieces.

Hsu and Thomas (2002) used an instructional simulation called MtnSim on science learning. MtnSim is a simulation, which is defined in text as "a concept related to that of microworld, as a model or simplified example of complex natural phenomena". It records the usage of students to give feedback to both instructor and student. Intention of this qualitative study was defined as trying to address the aspects of simulation design and the impacts on students' actions and problem-solving strategies when they explore the simulation. Based on the positive results of the study, authors make two recommendations. First, the simulation should be demonstrated and its features should be explained. Second, the recordings of students' work with the simulation should serve as the instructor's guide in structuring these activities.

Barab, MaKinster and Scheckler (2003) conducted a study involving the design and evaluation of an electronic knowledge network, the Inquiry Learning Forum (ILF) for grade 5-12 mathematics and science pre-service teachers. Authors stated some offers of creating learning community and importance of usage. The important factor that needs to be taken into consideration is the importance of caring inside

dynamics instead of using external design principles i.e. the need of users is more important than the pre-configured principles.

McClelland's (2001) study on 163 students taking Market Research Methods course at Liverpool John Moores University. In the study an online source for lecture notes, presentations, individual learning resources, workshop questions, revision materials and links to other related sites were used. The results showed that there is a significant difference between web site usage and gender of user, age of user and computing skills of user. But for undergraduate students (102 of 163) there is no significant difference between web site usage and their computing skills. Another result shows that there is no correlation between different learning styles and perception of the web page. The most important result of this study is saving £4000 on printed material by using the site for one semester. Author also states that students perceived an increase in quality of teaching and availability of learning materials.

Both traditional and distance education have some disadvantages. The best way is to combine the advantages of both. Horton (2000) stated that the most effective way is combining the conventional and on-line education. Another example was cited by Gouveia (2001), Walkden and Sharp proposed the parallel ideas with Horton in terms of advantages of hybrid learning systems. Thorne's (2003) study approaches to the web supported instruction with the commercial firms' perspective. Rolls-Royce PLC, Diageo PLC, DaimlerChrysler UK LTD, Avis Europe PLC, Ashridge etc. combined the advantages of traditional and online education. Although the usage differs like teaching Enterprise Resource Planning (ERP) software, the common point is decreasing the cost and increasing the success rate of the education. This can be utilized by means of web supported instruction. Also in Türkiye some commercial firms started to offer web supported instruction to their employees in order to decrease the cost of the education.

Taking all these information into consideration, it can be said that systematical usage of Internet can improve the quality of education without much investment. Traditional instruction can be supported with presenting the summaries on the web page. In addition, discussion list or forum usage may improve the achievement of students. Besides, supportive information on the web may lead to a decrease on the usage of printed materials.

There is another point for consideration. Internet is a new medium for the instructors in Türkiye. Maybe it is not for searching and using web pages but it is for preparing web sites. To construct a site requires at least some HTML knowledge, which is the basic programming language of Internet. It requires even more programming knowledge if the instructor needs more advanced sites such as database usage, tracking students' activities, file upload or forum preparation.

In this study, the constructed web site was used to investigate the students' perceptions about online support for a traditional course. Also attitudes of the prospective instructors about the system will be analyzed. The prepared site of this research prevents the instructors to spend time for learning programming languages. In this case instructor spends his/her time to improve the content of the site instead of its infrastructure.

PART II

If it was not useful, we would rather not to use it. Technology can be problematic in most cases. It needs maintenance and capable personnel to use it. Moreover there should be a strategy and carefully constructed materials. So it is important to analyze and understand the best usage of technology according to the subjects of the study. To define the most effective usage related studies will be analyzed in this section. This analysis is composed of general perspective, computer mediated communication, and analysis for the modules that can be integrated in the proposed system.

Technology Usage

Moore (1997) focused on a movement to reform the teaching of statistics such that the researchers and teachers should focus on the synergy between content, pedagogy, and technology. Using technology in statistics instruction helps to automate many routine operations and as a result, facilitate conceptual learning.

Moore's article obviously has emphasized important factors for the statistics education. However Garfield (1997) had critics of Moore's article in his paper. He stated that there are successful improvements in the instructional materials quantity, technological infrastructure, and guidelines of statistics instruction. These areas are the ones that have successful changes according to Garfield. But there are some factors that have not changed. One of them is teaching methods that the instructors may be unwilling to change the methods they used to. The second factor is the fear of the students about subject area. Students have also anxiety about the difficulty of statistical concepts. The former factor can be result of the latter, because the instructor can resist changing the strategies as the students are unwilling to learn.

Forster (2007) summarized the online resources for statistics education. Freely available Data sets, text based resources, spreadsheet programs and java applets. Although the article is a result of a study for the secondary school level, some of the mentioned resources are relevant to graduate education. So these resources were also added to the prepared online support system for this study.

Kay (2006) has conducted a review of literature about technology integration into pre-service education. The important point in this study is the technology investment is necessary but not sufficient to improve the quality of the education. The usage strategies must be developed in order the appropriate usage of technology. The researcher tried to provide a strategy for technology usage in statistics education in this study.

Allan (2007) summarized the blended learning tools and technologies as listed below:

- Technologies in the classroom such as Power Point and interactive whiteboard
- Virtual communication tools such as discussion boards, chat room and podcasting
- Social networking software such as blogs and wikis
- E-learning systems such as VLEs and group collaborative software
- Mobile learning.

ATutor framework used in this study contains almost all of the mentioned tools. All types of files can be added to the system. Private messaging, discussion board, chat room, and blog part are already integrated. Groups can be conducted in the system and group special tasks can be given. In addition all types of mobile devices that are able to use browser can be a medium to use the system. The characteristics of the communication tools that can be used in the ATutor LCMS are summarized in the computer mediated communication part.

Computer Mediated Communication

Computer mediated communication (CMC) refers to human communication via computers and includes many different forms of interaction that humans have with each other using computers as tools to exchange text, images, audio and video. (ISP Glossary, n.d.) There are mainly two types of CMC: Synchronous and asynchronous communication. In asynchronous communication students and the instructor can get onto the system at any time they want, post their discussion, comments or opinion for others to view later. Where as synchronous communication is a system that both students and the instructor are logged into a system and communicate with each other at the same time. (Xiaoshi, 2000)

Private Messaging: Private messaging is a type of asynchronous communication. Electronic mail (e-mail), a service for sending messages electronically, allows communication among people regardless of status of people, referring to be online or not. Moreover, the exchange of electronic text messages and computer file attachments between computers requires people have mail account that is a place where someone can contact another person. Furthermore, e-mail address is to be unique name that identifies an e-mail recipient for the transfer of information from one computer to another. With using an e-mail, it is possible to store, send, compose, forward and receive messages over electronic communication systems.

E-mail is also can be used for many purposes like other educational social software. These purposes can be mainly for communication and transformation of information. Palmer (2000) told about internet usage in education that the WWW (for the delivery of multimedia content) and e-mail (for basic electronic communication) are two important Internet services for teaching and learning. When students and

instructors cannot easily arrange face-to-face meetings, it is important to use e-mail communication (Lightfoot, 2006; Le & Le, 2002).

As an easy method to send messages, information or other kind of materials by just a few mouse clicks, instructor may take into consideration some issues. Instructors can choose a topic that individualized communication can take place and create links outside of regular space, time, support detailed analysis and reflection; give participants insight into others' perspectives; and keep records of the dialogues and messages (Cook-Sather, 2007).

In this study course support framework has a function to support private messaging. The user can send messages to any other user. This user may also be the instructor or assistant.

Forums: Forums is another type for is a type for asynchronous communication. A forum is an asynchronous platform where students can communicate by posting messages and responding them for collaboration or discussion. When it is used for academic discussions or out-of class activities, online forums can enhance learning processes (Thomas, 2002). The mostly mentioned educational advantage of online discussion forums is the time available to read a message and think about a response, which can help to improve reflection upon and development of a topic (Guiller & Durndell, 2007).

Discussion forums can be used for many different purposes in different educational environments. These purposes may be as a support to distance or blended learning for social interaction, for discussion of topics, for frequently asked questions, and for individual homework or group projects as a collaborative tool. Differentiated according to the purpose of the forum, instructors may "limit discussions to one or more instructor-initiated themes, lead more general discussions, assume the role of answering most of the questions from students, and moderate

the discussions but maintain a low profile in them, or even be entirely absent from the discussions" (Mazzolini & Maddison, 2003, p. 238).

The discussion in the forum can be often carried out easily within small groups, including between four to eight students for learning sets or medium sized groups, including between 20 to 30 students for the discussions. On the other hand, when it is set up for very large groups, there may be disappointment with levels of participation and there may be disorder of posted messages that become unmanageable. Conversely, in small groups it is easy to flow the messages and information and also participation level of the students. The participation into discussion is not only important face to face environments, but also it is an important concern within any small group in online environment (Hammond, 2000).

The provided course support framework has integrated forum system as well. The users can read and reply the forum posts anytime they want. Forum usage provides sharing ideas that every user can easily attend asynchronously.

Chat: Synchronous discussion, or chat, or instant messaging refers to online dialogue occurring in real time. In chat sessions, unlike asynchronous communication, there is no time delay between the sender's transmission and the receiver's receipt of the message (Borowicz, 2004).

Instant messaging engages geographically distant students in synchronous dialogues and offers a flexible platform for knowledge construction. Moreover, chat can be used to enhance out-of class learning activities by supporting collaborative learning, improving communication (McCreary& Ehrich, 2001).

Chat can be used in educational settings for many purposes. For example, in distance education meeting with students once a week or twice a week, meaning regular meetings, for online discussion is the core of the distance courses. Moreover, in blended environment other activities can be arranged in which students from a variety of locations all are given a problem to solve as a group, meaning virtual problem solving groups. Students can invite their chat sessions other expert in various fields, community leaders, and others. Furthermore, it is possible to communicate other people to practice language skills with the help of chat programs (Ingram, Hathorn & Evans, 2000).

For effective usage of instant messaging in courses and to affect the quality of educational discussions, Ingram, Hathorn, and Evans (2000) point out some critical issues to the educators:

- Environment: If the graphical environment of the chat rooms is important, it is advised to use a chat program supporting graphical-based programs instead of text-based ones.
- Task: A clear discussion topic or detailed product expected at the end of the discussion should be offered to the students. Second important issue for offering task is type of task. That is tasks require research and review other materials should not be appropriate for this type of synchronous online discussion tools.
- Rules: A clear set of rules is useful for controlling and directing discussions in the chat sessions. It is also important for students when to write and when to read.
- Group-size: Synchronous online discussion tools usually work best with small groups of three to five students. When group size is larger than this range, it is advisable to divide discussion groups into separate groups in different chat rooms.
- Identity: To prevent a student to hide own identity, it is advised for students use their own name and not to mislead with nick names rest of the group and teacher.

- Moderation: According to some reasons such as large group size, task type or level of students, the instructor may prefer to find a moderator to lead the discussion and keep it on track.

Instant messaging, a synchronous tool mostly used to communicate, can be also used to support distance and blended learning to enhance learning activities by supporting collaborative learning. Possible activities may be performed by using chat programs in educational settings: short discussions individually or as a group, role playing, conversation in different language, word and grammar games in different language, brainstorming, and summary of a subject taught before, problem solving activities, case study and peer review/editing.

Chat usage is used to share ideas synchronously. This is the fastest alternative to forum usage. However attendance can be limited in chat usage as every user should be online at the same time. The course support framework has also chat support. Besides, the system can log the conversations for further analysis.

Blogs: Blogs can be considered as a part of asynchronous communication. Blogs are one way of communication effectively in online environments, and innovative usage of them in education is appearing nowadays. Originally, "Blog" is an online diary posted on the Web that includes publication of the personal thoughts, feelings, hobbies, and experiences in a chronological order.

Moreover blogs can be defined as online writing tools that helped their users keep track of their own online records (Hsu & Lin, 2008). Anyone who doesn't have advanced computer and internet usage skills can create web pages, and express their feelings to the others by the help of blogs. Furthermore, blog users and non-blog users can post their comments on the written issues easily. Depending on authors' preferences, these online writing tools can include some features such

as links to other blogs, author's detailed profile, and most importantly feedback from readers (Ellison & Wu, 2008). Blogs can be used for many purposes but when they are used for educational goals, they can enrich the classroom environment and facilitate social interaction among students. Educators can integrate blogs in blended and online learning for some specific strategies (Oravec, 2003):

- posting student works,
- exchanging hyperlinks,
- fostering reflective approaches to educational genres,
- forming and maintaining knowledge communities.

Besides, usage of blogs can address some theoretical underpinnings that are summarized below (Glogoff, 2005):

- In instructional blogging, a knowledge-centered instructional tool, the instructor designs research activities that engage students in discussions with practitioners, and lead them through developmental concepts of the discipline's knowledge domain.
- In learner-centered blogging that acknowledges the important attributes of learners as individuals and as a group, the instructor gives positive feedback to students regarding their comments and by posting comments to discussion. By this way learner-centered blogging offers particularly useful opportunities for learner-centered feedback and dialogue.
- For providing community-centered instruction, blogging supports the importance of social and peer interaction.
- As a receptive learning tool, blogging can encourage students to acquire information from resources and reflect what they have gathered.
- In a directive learning environment, blogs provide students with equal access to information, to expand students' understanding

of specific issues, and to direct students to explore additional material.

- As a guided discovery and knowledge construction, blogs can also be used to present information architecture and explore more from web sites for other content.

Hake (2008) mentioned about “thirty two education blogs”. He collected the useful education blogs in his paper. Some examples of these blogs are;

- Mathematics Education Research Blog by Reidar Mosvold,
- The eLearn Blog by Lisa Neal Gualtieri,
- Rational Mathematics Education,
- "an island of rationality in the insanity of the math wars" by Michael Paul Goldenberg,

Hake showed that blogs can be used as an important educational medium by means of its practical usability. Perhaps the blogs can be considered as the fastest educational medium because of publishing information for the worldwide usage in seconds

As a summary among many purposes, blogs can be used in educational environments. Publication of any materials, course notes, reflections may lead others to review, comment or study. At the same time, blogging not only supports individual sharing but also allows other visitors to interact with both content archived, blog readers and owner. Blogs is the best way to share the ideas without being afraid of criticized. Support framework provides blogging support for the users as well.

Computer Based Assessment

Technology is not only a medium for presenting information for easy access, but also a medium to assess the performance of the learner. Fast and reliable evaluations can be done by computerized environment. It is also ease the evaluation procedure.

Lawson (2002) mentioned about the benefits of computer based assessments in his paper. Computer based assessment can be used from everywhere. Also he stated a disadvantage here as easy cheating. But he also provides a solution for this as administering the assessments in a controlled environment. But this is not a different situation from the paper and pencil ones. The advantage can perceived here as practice opportunity from everywhere by the learners. Second advantage is immediate feedback. Unless the question is open-ended it is possible to give immediate feedback to the learner. Another advantage is repeated practice. As it is possible to use a question bank, questions can be re-used, shuffled and changed easily. The last advantage of computer based assessment mentioned by Lawson is anonymity. There is no anxiety of assessment according to be assessed by human. This is especially important for private questions.

Richman et. all (1999) conducted a meta-analysis of 61 studies about computer administered tests. The result of meta-analysis is that there is no medium effect on the scores. The study also showed that in case of the interviews it is better to use computers. Another important point that was mentioned in this study is the usage of open ended types of questions. Even in standardized tests there is also a writing section. The past assessments consisted of multiple choice questions. Last years they are included the open-ended ones. Computerized assessments overcome the unreadable handwriting problems and also save resources. Russell and Haney (1997) found similar results about computer based assessments. They compared the computerized and

paper and pencil tests. Although there is no medium effect i.e. there is no difference between two types of assessment, students accustomed writing on the computers, got higher scores on computers for writing questions.

Course support framework in this study has also assessment capability. Instructor can easily conduct computerized assessment without much effort. The system has easy to use assessment procedures.

PART III

To propose a solution for the obstacles may be the easiest part of the complete solution. It is nonsense to solve a problem by means of not usable suggestions according to the potential users. So it is very crucial to consider the intended users. This section will consider the instructors, students, and administrators in order to prepare the best support system.

Teacher Perspective

As mentioned before Garfield (1997) stated the instructors' resistance to the change. Technology support is subjected to this resistance. However instructors cannot be blamed for this resistance. As also mentioned by Garfield, learning to use the new technologies, preparing technological course materials or simply preparing a web site for the courses does not have influence on the instructors' promotion. If the instructors will have to spend more time for a course with synchronous or asynchronous communication purposes, it is likely to have resistance about technology usage from the instructor. They are obviously trying to spend little time for courses in order to get promotions by writing articles or research studies.

As presented in Emmungil and Akleylek (2008) study, online support for courses is not a big deal for the instructors. Every instructor can have technology support for their courses with a little effort. A desktop computer or freely available hosting services can easily be a portal for this support. The technology usage for educational purposes is not a computer expert business anymore. One of the aims of this study is to help the instructors with pre-prepared online support system. This will ease the obstacles for the instructors who did not get used to have technology support for their courses.

Student Perspective

Lifelong learning became one of the most popular concepts. As information increases day by day, it is not possible to teach everything to the students. Instead, they have to get the knowledge whenever they need. As it is not possible to get back to classroom to learn the required knowledge and also there is no end for learning as the knowledge have always been increasing, lifelong learning becomes popular. As the learner have to reach the knowledge and it is obvious that it is becoming harder to find relevant information by searching the internet, it is likely the people will need academic knowledge from their instructors even after graduation. Instructors cannot help everyone over the phone, but they possibly have information on the internet. Then students can reach the required information by using these sites.

As cited by Çetiz (2006), Bates classified the current pressure on higher education institutions to change as the need to do more with less, the changing learning needs of the society, and the impact of new technologies on teaching and learning. In this perspective it can be said that the higher education institutions have to use technology in an appropriate way to keep up with the instructional requirements of the new era.

A study about statistics education was conducted by Yılmaz (2006). The study revealed that the most of the students who received instruction by real data based and calculator supported statistical activities, expressed that the calculators made the lessons enjoyable and the study easy. Calculator usage has an advantage about technology integration into courses. Calculators are not perceived as high technology, so that there is no fear of high technology usage. So it is possible to use the calculators as a bridge for transition to computer from blackboard. It will be easier for the learners to be accustomed to computers if they see the computers as advanced calculators.

Statistics is one of the most difficult concepts in education. The pie charts below show the failure rate in statistics course during four academic years of one of the private universities in Ankara. The high failure rate shows the students' difficulties on learning statistical concepts.

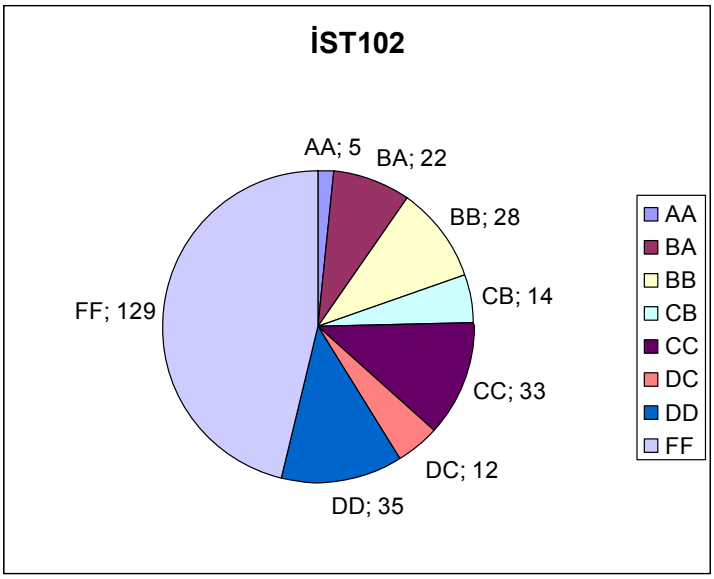


Figure 1.1: Distribution of İST102 Course Grades

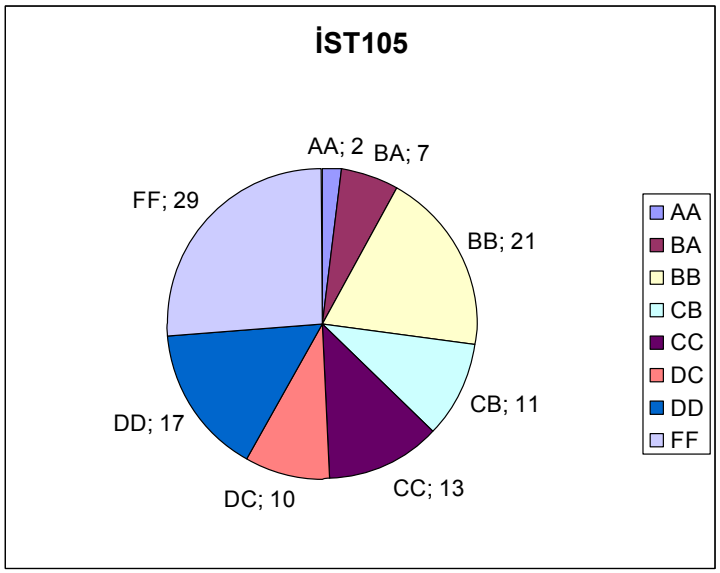


Figure 1.2: Distribution of İST105 Course Grades

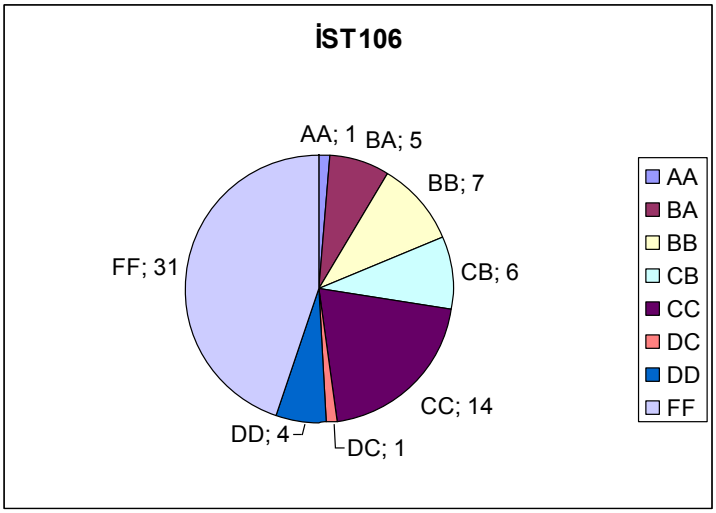


Figure 1.3: Distribution of İST106 Course Grades

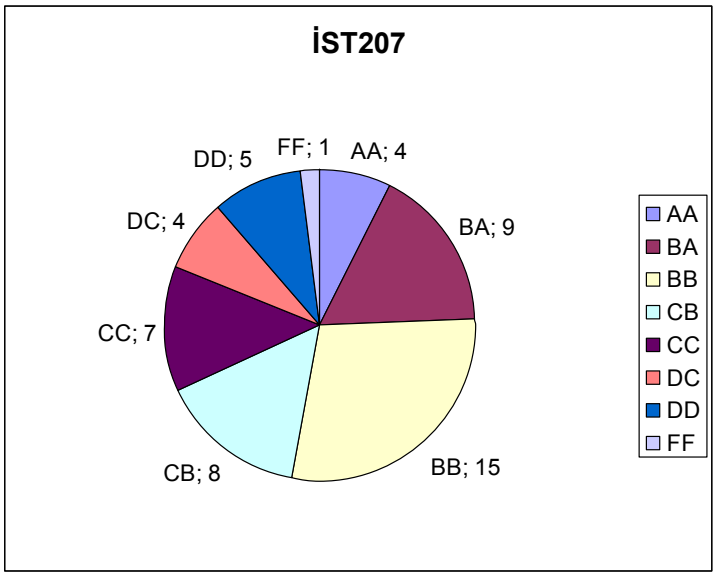


Figure 1.4: Distribution of İST207 Course Grades

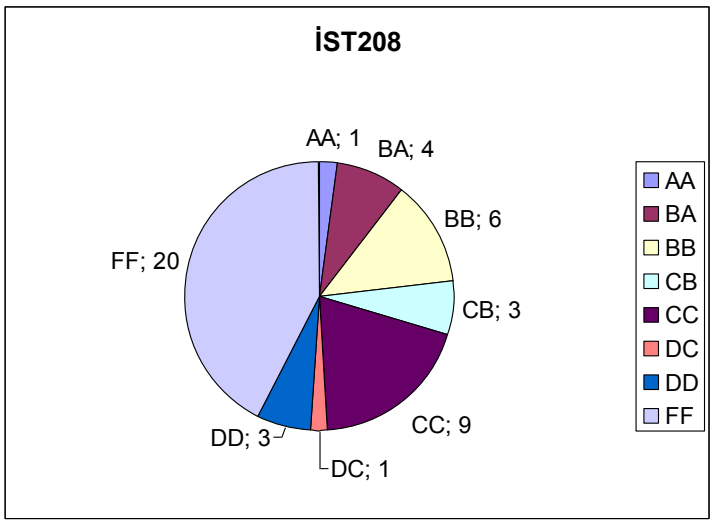


Figure 1.5: Distribution of İST208 Course Grades

It can be seen from the pie charts that except İST207 course, there is a high failure rate in the statistics courses. So it can be said that there is a need for improving the success rate in these courses. This can be possible with the help of technology. A support may improve the

attitudes of the students toward the subject, and help the instructor by presenting the materials for the students which can be used any time.

Besides the educational statistics course is one of the two compulsory courses for graduate students of education faculty. The reason is the need for students to use statistics during their whole academic career. So even memorizing is not helpful to be a successful instructor or academician. Statistical concepts must be learned with high retention rate. Another perspective is the software usage part of the statistical courses. There are laboratory hours for the students to practice with statistical software on the computers. So beside of the statistical concepts, students have to learn the software usage for this course. This increases the responsibility of the instructor. At the end of the semester the students must be capable of correlating both the theoretical knowledge with practical knowledge. This objective makes the instructor and students give very high effort to complete the course successfully.

Kay (2006) summarized from some articles that pre-service education is probably the best place to start the technology integration. The intended target of this study is the in-service or potential teachers. But many of the subjects have taken very few technology supports in their courses. This study may also be a model for the students for their own offered courses in the future.

Administration Perspective

Yılmaz's (2007) study with 117 participants and 7 experts about online or computer based assessment usage revealed that assessments can easily be conducted online. The perceptions of the subjects were positive to the online assessment. Using the online assessments will bring some benefits for the administration as well as instructors. As mentioned as one of the advantages of computer based assessment by

Lawson (2002) it is easier to conduct assessment by selecting questions from a question bank. As Richman et. all (1999) concluded the result of their meta-analysis computer based assessments decreases the operations cost for the administration. Considering having already technology infrastructure, there will be no paper and printing costs for the assessments. Mistakes can easily be corrected for the computerized questions.

Universitat Jaume I (2004) compared ATutor, Moodle and .LRN. Then Moodle was decided to use. Also Open University decided to move to Moodle from a commercial LMS (Open University chooses Moodle!, 2005). Moodle offers more add-ons and it has bigger community than ATutor. In an enterprise level both platforms are usable. However especially personal level, Moodle is harder to maintain and controlled. Mack & Nielsen (1994) defined the usability as a fairly broad concept that basically refers to how easy it is for users to learn a system, how efficiently they can use it once they have learned it, and how pleasant it is to use. Usability is very important for the LMS because all of the users should use without any difficulty. ATutor system has advantages over Moodle in terms of usability. ATutor can be installed and used by almost everyone in any platform, whereas Moodle requires some technical knowledge. This is the reason that in this study base framework was selected as ATutor.

- Competitive advantage: Using LCMS for educational environment will bring competitive advantage for the institution. It can be used as a medium for advertisement. Moreover it is an indicator for self evaluation. Administrators can use the LCMS as an indicator for success of the learners. This evaluation process would be faster than the institutions those not using LCMS.
- Cost Reduction: LCMS usage will help institutions for decreasing the administrative costs. Correcting mistakes cost nothing in an

LCMS environment. Announcements can be done to all intended people in seconds. The paper and printing costs is at the minimum level during the LCMS usage.

- Acceleration for intended outcome: As mentioned above, LCMS can help to define the achievement level for intended outcome. It is possible to overcome the difficulties as fast as possible during LCMS usage.
- Consistent and timely content: Having all the control during the LCMS usage by the administration, the content can be restricted to be used in definite time intervals. This will help to eliminate knowledge that became irrelevant

PART IV

It is also important to analyze the proposed web support system framework. In this section ATutor; the selected Learning Content Management System, will be analyzed in detail. Especially its functions, design issues, and philosophy of the system will be emphasized.

ATutor LCMS

ATutor is an Open Source Web-based Learning Content Management System (LCMS) designed with accessibility and adaptability in mind. Administrators can install or update ATutor in minutes, create custom themes to give it a new look, and extent its functionality by enabling or developing feature modules. Educators can quickly assemble, package, and redistribute instructional content, and conduct their courses online. Students learn in an adaptive learning environment (What is ATutor?, 2008). ATutor LCMS modules are listed below:

- Content: Nowadays the learners prefer to use computers instead of reading textbooks. You can present the readings with this system and want them to read the necessary parts. Integrated search function is important because the learner can reach the related parts quickly. Before the lesson, students may read the chapter or its summary. After the lesson they can reread any part they need. The content part can be used for text, graphics or animation sharing.
- Reading List: Other than the readings provided by the instructor, some other resources can be provided to the learners about the subject. By this way learners can reach to the resources without being lost in the mess of the internet.
- Groups: ATutor provide cooperative working environment as well. By this way different groups may have different objectives or

tasks. Groups are able to use their own file storage part, blogs and can take group specialized tests.

- Messaging: Learners can post messages to other learners or the instructor inside the system. They can see the online users and share information. Messaging can be used for private communication such as communication between group members.
- Chat: Chat is another part in the ATutor LCMS. All of the users can communicate simultaneously. Online discussions can be conducted under the control of the instructor. The communication can be logged by the system for further analysis by the instructor.
- Forums: Forum part is similar to a mail group. Learners can read the forum posts whenever they want. Research or discussion questions can be placed here. It is also an effective communication tool. Threads can be locked for posting and/or reading.
- Students Tracking: All learners are being tracked by the system, and instructor can see the students' usage time. How much time was spent on the content can be seen with ATutor. Also all of the submissions to tests and surveys are recorded. Instructor can analyze the learning difficulties by these records. Moreover, students can see the usage records of their own.
- Tests and Surveys: The instructor creates a question database with the following types: Likert, matching, multiple choices, and multiple answers, true-false, ordering and open ended. Then he/she prepares an examination by using these questions in the system with any properties. These properties are intended students, pass score, feedbacks, start and finish time, questions, points etc. As the questions are used from the question database, they can be used repeatedly. The examinations are started, finished and evaluated automatically. Automatic

evaluation can be used for all types of questions except the open ended ones.

- Announcements: In the main page instructor can place important information as announcements. Syndication of announcements via RSS can also be enabled.
- Polls: The needs of the learners can be found immediately by the polls. The individual votes cannot be seen for the polls.

Adaptive Technology Resource Centre provides (ATRC) information about the design philosophy of ATutor in their web site (ATutor, 2008). In designing ATutor ATRC has had the specific goal in mind of creating an adaptive learning environment that anyone could use. This is an important point that, usability is one of the most important points of the designing phase. Regardless of how people go about learning, and regardless of the technology they might be using to learn online, ATutor is designed to accommodate all learners.

Human learning is highly complex, and ATutor can't hope to adapt to all the intricacies in the ways people interact with the world. A simplified six point model that draws on popular understanding of learning and the structure of knowledge provides a starting point for developing an intelligent learning environment that adapts to all who use it.

Underlying ATutor's navigation structures and visual presentation is an understanding of the perceptual forms information takes on, an understanding of the senses through which people prefer to absorb and process information, and an understanding of the structural representations knowledge takes on in memory. Perceptual style refers to the tendency people have to lean toward learning strategies and learning situations that favor their visual, verbal, or their kinesthetic faculties. These faculties roughly correspond to abilities of imagery, auditory/verbal processing, and physical coordination (Studying Style,

n.d.). In most cases learners use all three faculties, but tend to prefer one over the others.

Visual: Making up about 65% of the population, visual learners absorb and recall information best by seeing. Visual learners like to see or imagine things as their preferred means of learning. They learn by watching or viewing information. Knowledge tends to be represented in pictures. Architects, artists, and engineers tend to be visual learners. Icons are used throughout ATutor to represent tools, ideas, and resources in visual form. The visual layout can be adapted to each learner's preference and saved for future use, providing a consistent arrangement of ATutor features and navigation tools. Hierarchical presentations within the menus and the Sitemap also provide visual representations of the content structure. Within the Global and Local menus a learner's position within ATutor content is always highlighted, giving them a visual cue to their location within a collection of ideas.

Verbal: Making up about 30% of the population, verbal learners like to hear or verbalize things as their preferred means of learning. They learn through hearing, saying and reading information. Knowledge takes on an auditory nature as new information is being absorbed. Writers, speakers, and public personalities tend to be verbal learners. ATutor is presented in verbal form by default. ATutor can be reduced to a text presentation alone if learners prefer to read (or listen to) content rather than view or visualize it. A text only presentation also ensures that all information can be accessed by any technology that reads HTML. ATutor development efforts also include the creation of a verbal feedback module (ATalker) that renders ATutor in audio form so learners can hear the environment as they navigate through it, and listen to content using an on the fly Text-to-Speech server. (Clark & Baggaley, 2004)

Kinesthetic: Making up about 5% of the population, kinesthetic learners absorb information best by doing, experiencing, touching, moving or being active in some way. Kinesthetic learners like to do or experience things as their preferred means of learning. They learn through activities and movement. Knowledge takes on a physical feeling of the circumstances under which learning occurred. Athletes, inventors, and craftsmen tend to be kinesthetic learners. ATutor is highly interactive and consistently presented throughout. Learners "use" ATutor to present content in a form that suits their perceptual styles, and can structure information into global webs, hierarchical trees, and sequential chains. Consistent layouts allow users to develop keyboard access strategies creating mental sequences of physical movements, or physical procedures, allowing them to automate their use of the environment and devote more mental resources to learning the content being presented.

Knowledge is "encoded" in memory in structural representations of relationships between facts and ideas. The perceptual "sense" of information as described above, is interconnected in Webs, hierarchies, and chains that arrange knowledge into "schemas" or "scripts" representing units of factual information or mental procedures, respectively.

Global: Global learners structure information in webs. Information is interconnected, with related topics linked to each other through weighted threads. Knowledge takes on a "big picture" structure through understanding the general concepts within a content area, creating a framework to which more detailed information can be connected. Information can be presented in "wholes" that allow learners to develop "big pictures" of topic areas, familiarizing themselves with the main ideas within a larger topic as a framework for learning the finer details. The Sitemap presents an entire ATutor course as a tree of linked page titles, allowing learners to see the course topics in their entirety and

jump around from topic to topic as they become relevant to ongoing learning. The Global Menu also presents the course as a whole, though the portion of the course displayed can be controlled by learners, giving them the ability to limit the amount of information presented at any one time. A course search engine also allows learners to move through content in a global manner.

Hierarchical: Hierarchical learners structure information in trees. More general ideas have subordinate ideas associated with them, which in turn have subordinate ideas associated with them. Knowledge takes on a structure much like a computer directory tree, with folders, sub folders, and files at varying depths. The Sitemap and Global menu, as well as the Local menu, the breadcrumb string, heading navigation, and Table of Contents navigation, provide learners with hierarchical strategies for moving "up and down" through ATutor content.

Sequential: Sequential learners structure information in chains. Topics begin and end, and follow a straight path through a sequence of ideas. Knowledge takes on a linear structure much like a time line, or step by step procedures. Next and previous links allow learners to move through ATutor content in a predefined order. If they leave the sequence of topics, to go to the discussion forums to post a message for example, they can use the resume link, or highlighted titles in the menus to return to the position in the content where they left off.

Another important consideration of Adaptive Technology Resource Center (ATRC) during the design of ATutor is accessibility. Web accessibility generally refers to the "inclusiveness" of web content, or the ability of people with disabilities to gain access to that information using assistive technology. It can also refer to access for those using older technology to access the web, those accessing at lower bandwidths, or those accessing with limited experience or other special needs. This part is very important for education. All users should easily

access and use the educational web sites. If they cannot, it will become a useless source although it has a good content. ATutor adopts many strategies to ensure accessibility to both learners of diverse skill and ability, and to learners using older or specialized technologies who are learning online.

The Web Content Accessibility Guidelines 1.0 published by the W3C provides the initial model of accessibility for ATutor (W3C, 1999). Guidelines represent technical issues that must be addressed to ensure that all attempting to access information can do so with relative ease. WCAG 1.0 provides the framework for creating an application that will work with any technology accessing it over the Web. Looking ahead to WCAG 2.0, usability is addressed with greater emphasis, providing guidelines for accommodating abilities as well as technologies (W3C, 2008). Web content adaptability addresses the inclusive usability of information.

Although there are some studies conducted about technology aided statistics education, they are insufficient in the amount according to other areas. Besides these few studies were conducted among lower grades. There is a need to find out and overcome students' learning difficulties about statistical concepts in graduate levels. Moreover, there is no study in Türkiye with this perspective to the statistics education. The literature presents many ideas about the needs and ways about improving the quality of learning process. Technology support is one of the strong alternatives. The researcher intended to prepare a study which will ease the use of technology support and also will be an example for this area.

CHAPTER 3

RESEARCH DESIGN

3.1. The Main Problem and Subproblems

3.1.1 The Main Problem

The main purpose of this study was to find the effectiveness of the constructed web-supported instruction on achievement related to graduate level educational statistics course. Also, this study examined the perceptions of students about web supported instruction related to educational statistics.

3.1.2 The Quantitavie Subproblems

3.1.2.1. Question 1:

What is the effect of supportive web site usage on academic achievement of the students, related to educational statistics?

3.1.2.2 Question 2:

What is the usage statistics of the site throughout the semester?

3.1.2.3 Question 3:

What is the usage statistics of the content part of the site throughout the semester?

3.1.3 The Qualitative Subproblems

3.1.3.1. Question 1:

What are the perceptions of students about web supported instruction related to educational statistics course?

- Sub Question 1:

What are the perceptions of students about the interface and usability of the support system?

- Sub Question 2:

What are the students' perceptions about support system in terms of understanding statistics and related concepts?

- Sub Question 3:

What are the students' perceptions about support system in terms of its use for computer laboratory sessions?

- Sub Question 4:

What are the perceptions of students about Content part of the system which includes course main points, SPSS usage, worksheets etc.?

- Sub Question 5:

What are the students' perceptions about support system's test and surveys part?

- Sub Question 6:

What are the students' perceptions about forum part of the support system?

- Sub Question 7:

What do students think about the poll section of the system?

- Sub Question 8:

What are the students' perceptions about support system in terms of file storage part?

- Sub Question 9:

What are the students' perceptions about support system in terms of glossary and frequently asked questions parts?

- Sub Question 10:

What are the students' perceptions about support system in terms of the links part?

CHAPTER 4

DESIGN OF THE STUDY

4.1. Research Model

Johnson (1995) suggests that educators "engage in research that probes for deeper understanding rather than examining surface features". He notes that qualitative methodologies have gained increasing acceptance in recent years and they are powerful tools for enhancing our understanding of teaching and learning. In addition, he states that it is very important to analyze how students learn, and how they can be taught more effectively as well as cooperating with practitioners in order to improve the quality of education.

In order to conduct deep analysis, this study can be considered as mainly qualitative study. The results of conducted interviews were mostly taken into consideration. Because the researcher was participant as observer in this study, the researcher’s observations were also integrated.

This study included also some quantitative measures in order to analyze the effectiveness of the web-supported instruction. As mentioned by Miles and Huberman (1994) the statistical tools of good quantitative studies are precious assets. When they are combined with the good qualitative studies, we have a powerful mix.

Patton (2002a) has categorized the qualitative research designs into three; Naturalistic Inquiry, Emergent Design Flexibility, and Purposeful

Sampling. Purposeful sampling does not generalize results from a sample to a population. It is aimed at insight about a situation. He also stated that qualitative inquiry focuses on relatively small samples, even the sample size could be one (N=1). Although quantitative studies depend on the sample size, it is not required to be high in qualitative approach.

4.2. Subjects of the Study

As cited by Hoepfl (1997), Patton explains the aim of purposeful sampling that seeks information-rich cases which can be studied in depth. Because this study has purposeful sampling qualitative study, sampling procedure was decided as purposeful sampling.

The sample was selected from the graduate level Educational Statistics course in the Secondary Science and Mathematic Education department of Middle East Technical University. Subjects of the research were the 21 graduate students from the Education Faculty. 16 of these students voluntarily accepted to be interviewed. The rest of the students were observed by the researcher in the classroom and laboratory hours, and also the usage data of the web site were used as quantitative data.

Mentioning about students by assigning Participant1 (P1), Participant2 (P2) etc. instead of their names provided confidentiality. These assignments were used according to the order that the students were interviewed.

4.3. Variables

Variables of this study are:

- *Students' Content Usage:* The time that the students spent on the content part of the site in terms of minutes.

- *Students' Site Usage:* The time that the students used the site in terms of days.
- *Students' Educational Statistics mid-term achievement grades*.
- *Students' Educational Statistics final achievement grades*.
- *Students' perceptions:* The results of the Constructed Web Site Interview provided in the Appendix.

4.4. Instruments

The two forms of data collection associated with qualitative inquiry are interviews and observation (Hoepfl, 1997). An interview was prepared and used in order to collect qualitative data. The site usage statistics were used as quantitative data in this study.

4.4.1. Educational Statistics Mid-Term Achievement Test

Mid-Term Achievement Test was prepared by the instructor in order to analyze the learning difficulties that the students have. The examination had mathematical calculations as well as theoretical concepts.

4.4.2. Educational Statistics Final Achievement Test

Final Achievement Test was prepared by the instructor in order to determine the grades of the students. Also this examination had mathematical calculations as well as theoretical concepts.

4.4.3. Constructed Web Site Perceptions Interview

In order to have qualitative data about the perceptions of the students, the Constructed Web Site Perceptions Interview was prepared and conducted after the study. The questions were selected to provide opinions specific to the constructed framework instead of general ones.

The type of interview is standardized, open-ended interviews among three types of interviews which are:

- Informal, conversational interviews
- Semi-structured interviews
- Standardized, open-ended interviews.

The instrument was prepared with the help of a subject matter expert as a standardized, open-ended interview. As there is more than one person to be interviewed, standardized interview would be more appropriate to analyze collected data. The Constructed Web Site Perceptions Interview is provided in Appendix B.

4.5. Procedure

In the first phase of the study, some informal, conversational interviews conducted with the Educational Statistics course instructors, and the students who took the course. After these conversations the framework of the study was almost completed. These conversations revealed that one semester with five hours a week is not adequate for the course. Another problem was forgetting the course content when it is need to be used. Mostly the information is used during the thesis stage, which is at least one year after the course has been taken. It can be three years in a doctoral study.

It can be concluded that it would be better to have a course support system both to decrease the work load on the instructor, and having a system that can be used after some time that the course has been taken. Learning Content Managements Systems were analyzed for this purpose. The available LCMS alternatives evaluated. The commercial alternatives decided as not cost effective for the instructors. The open source and freely available LCMS alternatives were compared. Moodle was the system which is widely used. But the system required higher technical resources and was not compatible with all types of computers.

Dokeos was another alternative. It was designed mainly for distance education. It was decided as not convenient for course support systems. The usability of Moodle and Dokeos found insufficient as compared with ATutor. NetClass system is another altenative which is used as the course support system in Middle East Technical University. However it was decided as inconvenient for the aims of this study. It was thought that the system will be available for the entire education world. So NetClass will have limitations as it is not a publicly available system. However the framework and content will be freely available. So the materials can be used in every management systems. As a result ATutor can be used in any types of computers and browsers easily. It is very simple to use and does not use high system resources. The framework was decided as ATutor for this study.

The web site content completed throughout the study according to the obstacles and students' suggestions. Researcher attended to the lectures during the semester; he was the participant as observer. The instructor did not mention much about the course site to the students deliberately. The aim was to overcome manipulated site usage. It is possible for students to use the course support system because the instructor requested to be used even if they did not need to. By this way it is possible to analyze the need for the system without manipulation of data by the students intended to get higher grades.

Only two introductory e-mails were sent to the students about the site. The e-mail introduced the address and intention of the study as "preparing and improving the web site content according to their perceptions and usage results". It was stated that the site was prepared to store all activities made by the user after they enter their username and password. The site was blocked to be used without enrollment. So the usage statistics were collected only the students enrolled to the educational statistics course. A back-up system was also provided to the students in case of any obstacles to use the main site.

The back-up system did not force the users to have enrolled with username and password. So the students had the opportunity to use the back-up system. The statistics of the back-up system was not analyzed in the related part because the users can also be people not enrolled to the course. These statistics showed as a figure in the analysis part in order to inform about the usage that is not evaluated during this study.

At the end of the semester, Constructed Web Site Perceptions Interview applied to the participants of the study one by one in their convenient time. The conversations recorded by a sound recorder with informing the participant. Then the conversations were analyzed to improve the system.

During all of the lecture and laboratory hours in the semester, the researcher took notes about subjects and examples in order to provide chapter summaries of each week, examples and questions at the web site. Researcher also looked for the misunderstood points by the students. Until the lecture was started and during the two 15-minutes breaks researcher tried to cooperate with students and instructor in order to evaluate and improve the web site formatively.

Supportive Web Site

There are many useful functions of ATutor Learning Content Management System used in this study. The interface language can be changed anytime by the links under each page of the site. Search function provided in each page. Also the system places the name and surname of the user during the usage. ATutor is open source and freely available which means that any education specialist or institution can easily use and integrate into their own system.

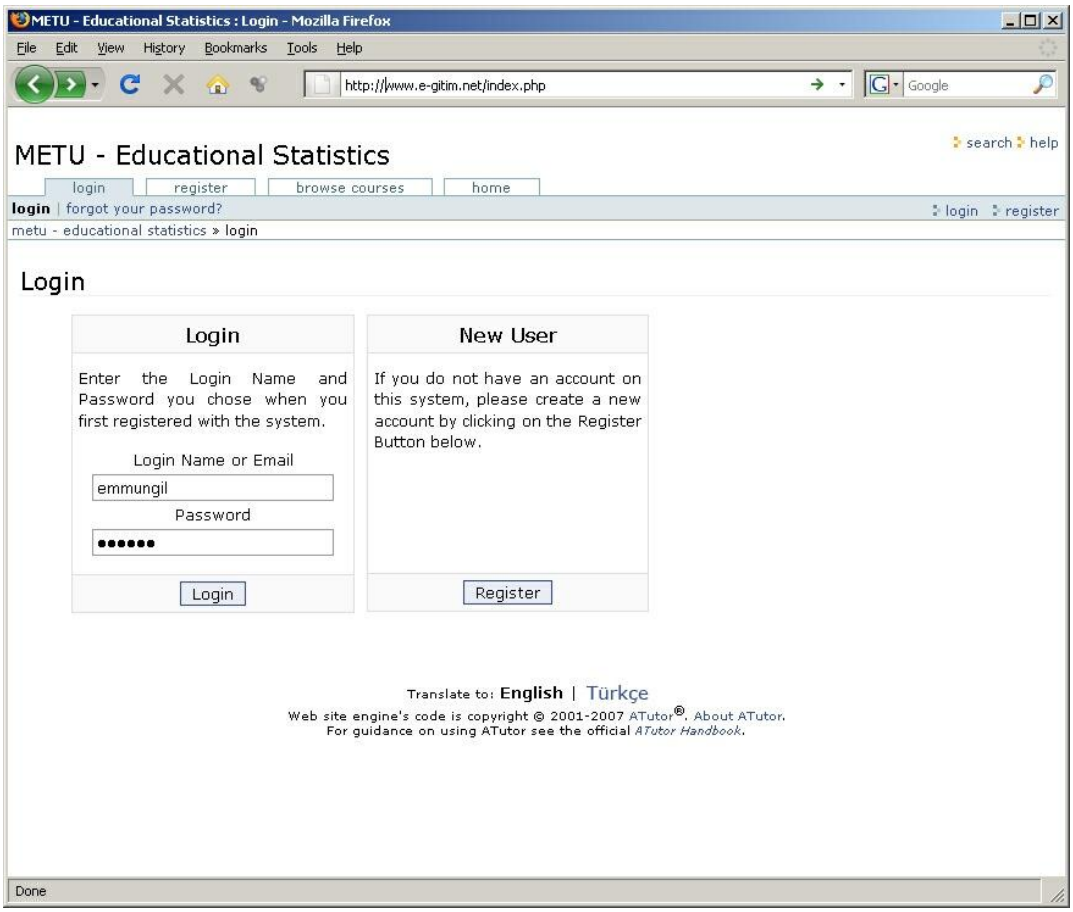


Figure 4.1: Login Screen

Although students do not have to register in order to use the site, in order to tracking the students, it is needed to sign them in by asking for a username and password. During the study it is forbidden to use the site without the login information. The username and password of the students were created and send them via e-mail. The system has functions of recreation of passwords in case of forgetting.

After logging in, the enrolled courses by the user are listed in the My Courses page as it is shown below.

Figure 4.2: Start Page

In the start page the enrolled courses are listed if there are any. The user can easily reach to the course that he/she enrolled. "Browse courses" alternative can be used to analyze other available courses. "Create course" function is only available for the instructor accounts.

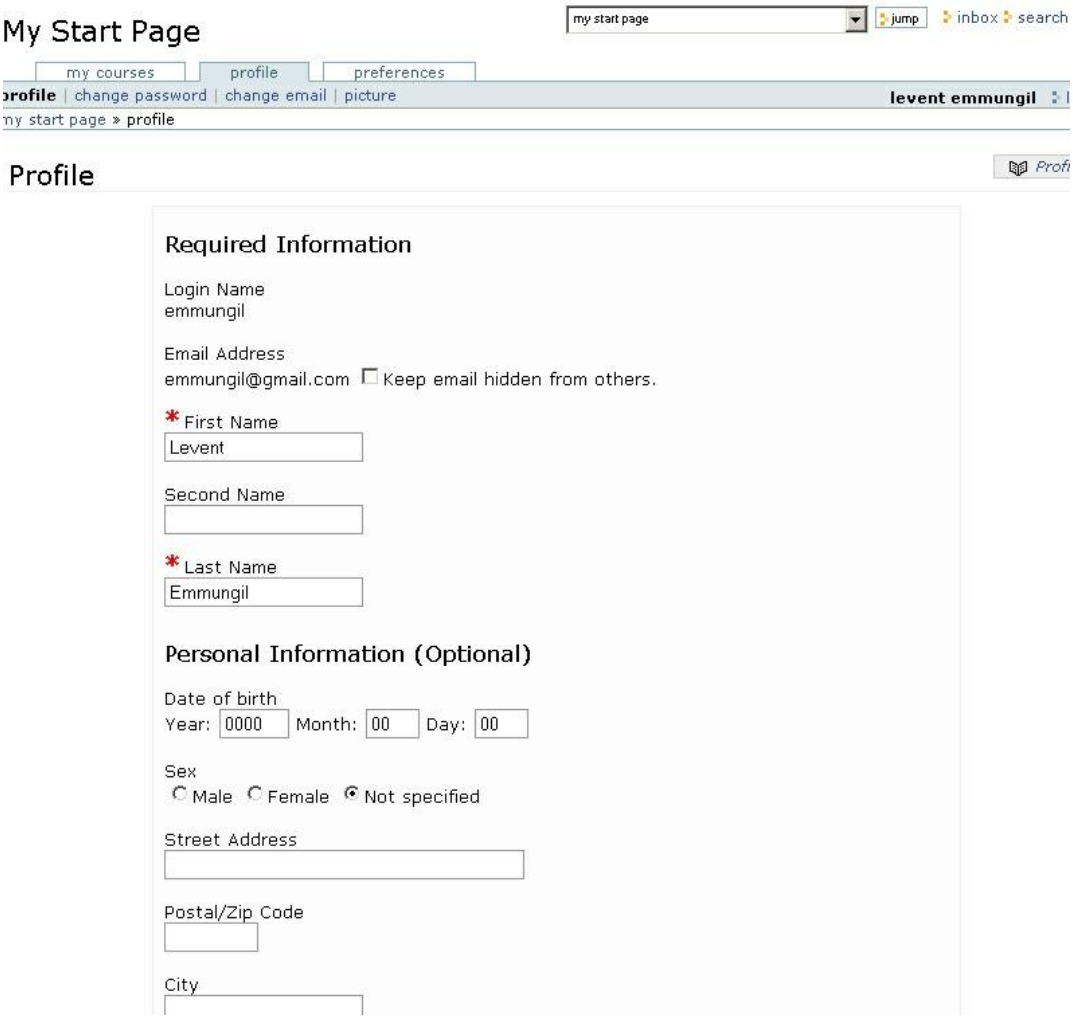


Figure 4.3: Profile Section

The system gives the opportunity to the user to control and provide any information he/she wants. The e-mail address can be kept hidden from the others. Personal information can be written into the system etc.

Figure 4.4: Password Change Screen

The user can change the password anytime he/she wants. The passwords must be minimum eight characters and also must contain characters other than letters.

Another important function of the system is having Preferences page. The design of the interface of the system can be changed here according to the user's wishes. User can use any of the allowed templates. Also the user has the opportunity to change some functions according to own intention.

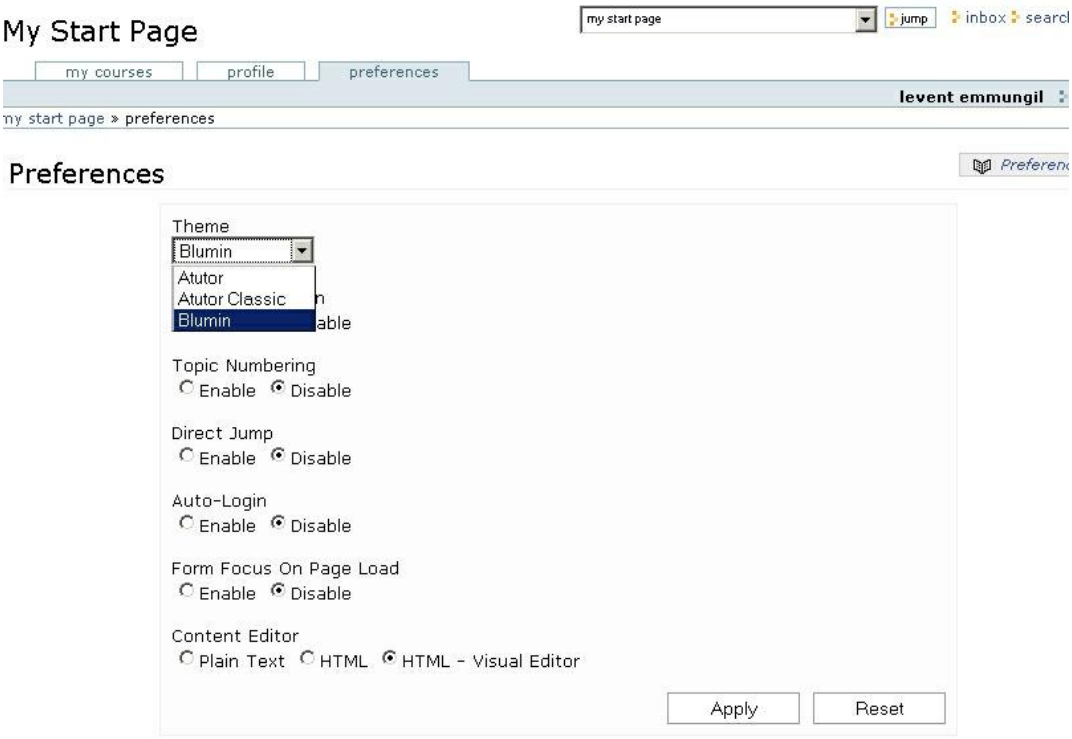


Figure 4.5: Preferences Page

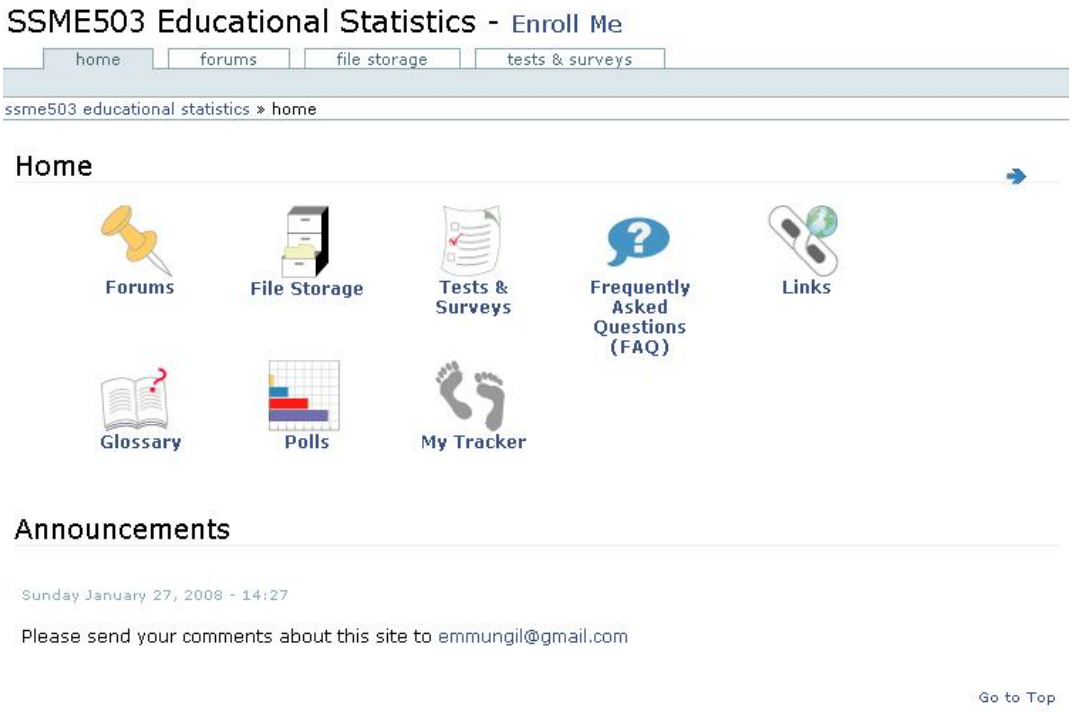


Figure 4.6: Course Main Screen

After selecting one of the courses that were listed, the main screen of the course is like in the Figure 4.6. The icons and top menu may change according to the selections by the instructor. The side menu also may change in this screen. If the instructor login with proper user name and password the "manage" link appears at the end of the top menu. The instructor can change the usable parts and their orders from the Student tools menu of the Manage section. Prepared announcements are placed at the end of this page. There may be more than one announcement and the newest places at the top of the list. The "enroll me" link next to the course name means that, the user has not been enrolled to the course. Some of the functions of the course can be restricted to this user. The user may send an enrollment request to the instructor of the course. The enrollment procedure may also be done without user request. The instructor can enroll the users from the enrollment menu in the manage section.

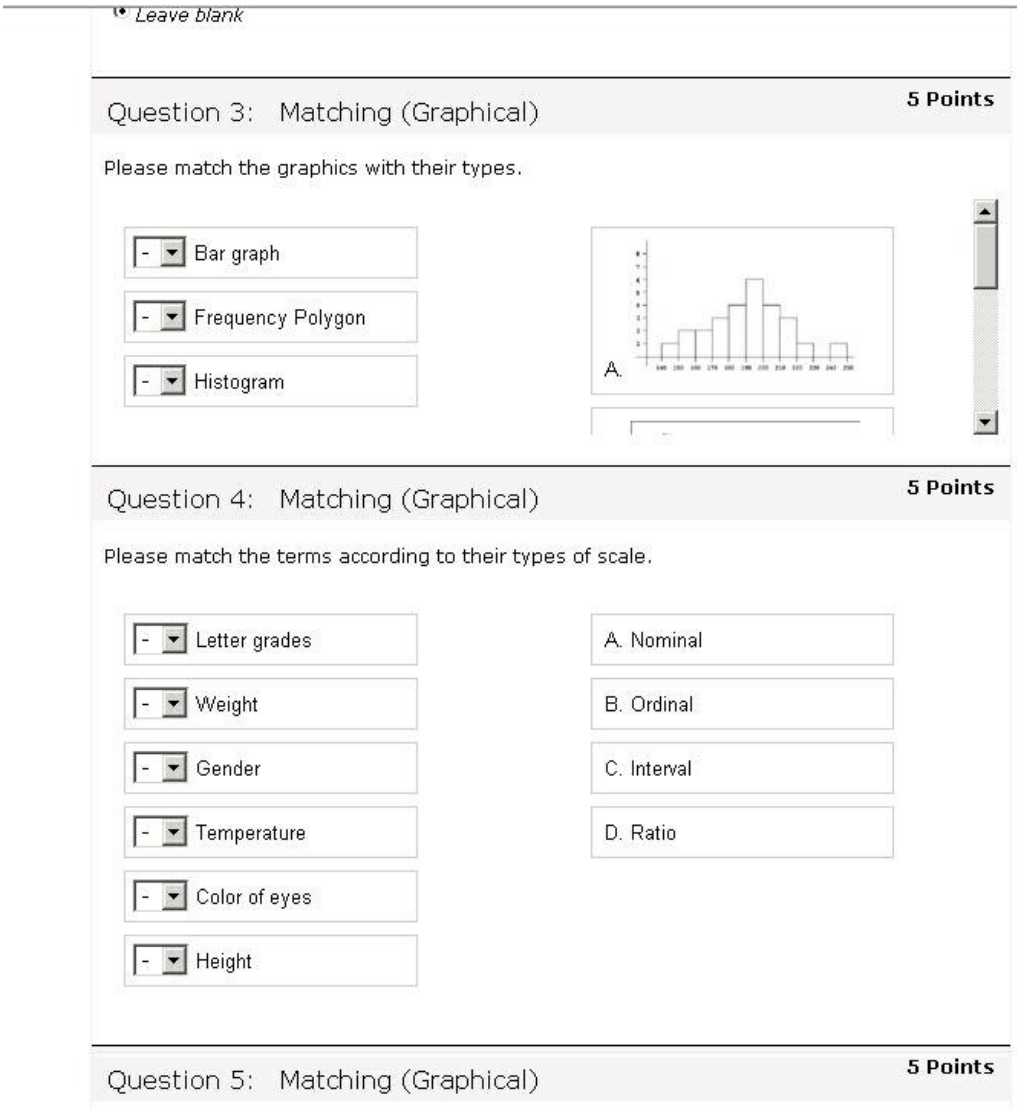


Figure 4.7: Test Screen

Figure 4.7 shows an example for a test screen. The questions are listed on a page. After a user answers the test, he/she press the submit button. If the instructor released the results, the users can see his/her own performance immediately. Except that open-ended questions, the system automatically evaluates the results. The question types can be selected among types of true-false, multiple choices, multiple responses, matching, open ended. Tests can be a combination of these types.

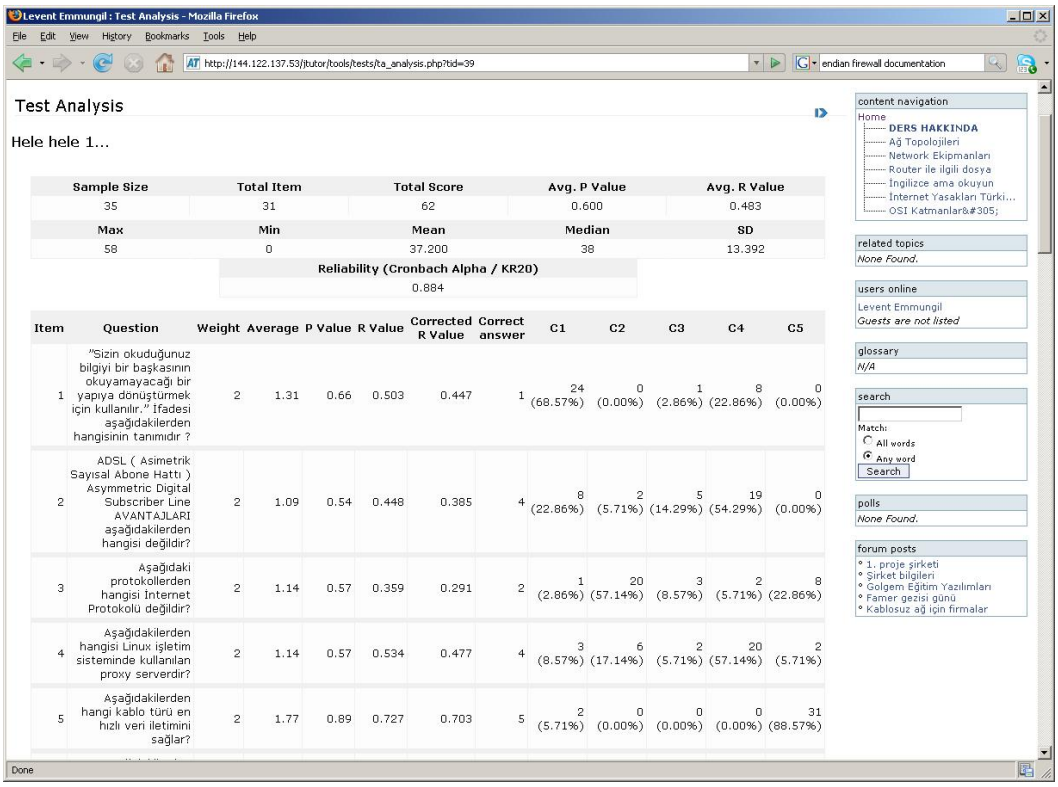


Figure 4.8: Test Analysis Screen

One of the powerful properties of the system is statistical analysis for the tests. The function became a standard one with the last version of ATutor. Test analysis function provides many statistical analyses including reliability in single screen.

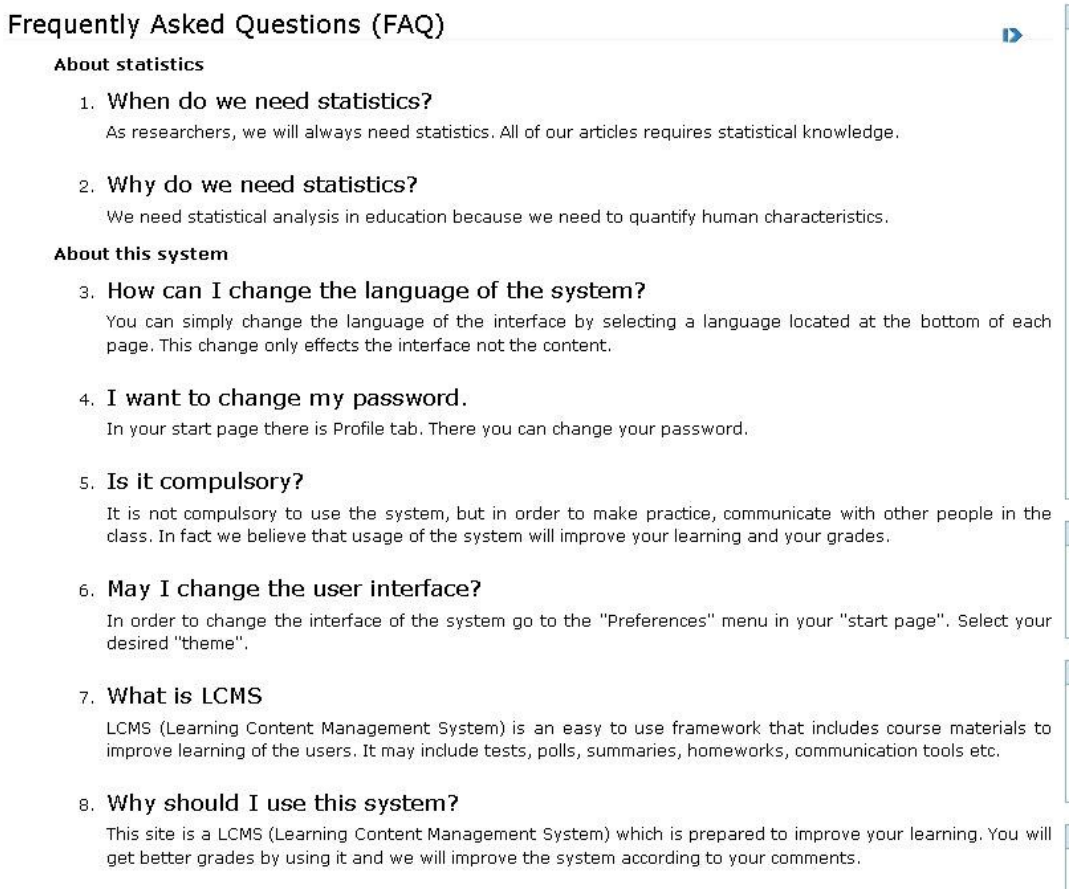


Figure 4.9: Frequently Asked Questions

Frequently Asked Questions (FAQ) can present basic information about the site, content, or intention. The instructor prepares this part from the manage section. It is usable especially for the first time users. It would be better to update the answers for each semester before the course starts.

Figure 4.10: Forum Screen

Forum is one of the communication alternatives presented in the system. Forum is used for asynchronous communication. Users can read the post whenever they want. Forum threads can be locked to posting messages or both posting and reading messages by the instructor. Figure 4.10 shows the forum of the system. Two of the thread has been locked because those threads have private information and the system is open for anonymous usage. The instructor can transfer or delete the threads from this screen.

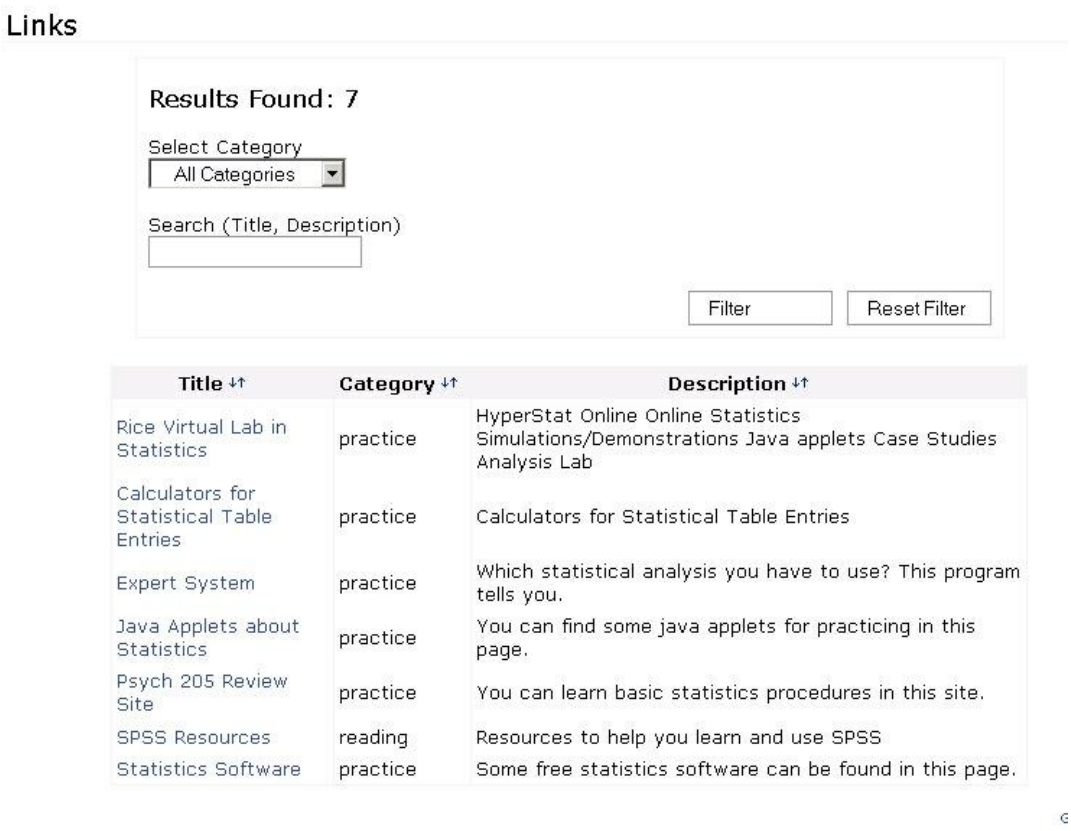


Figure 4.11: Links

The support system has many function built-in. Communication part, content part, file storage part etc. can have variety of information. These parts may not be enough for the instructor to present some information or he/she may want to link to an external source. The links part is used to link to an external resource. Also students are able to offer an external link, but this must be approved by the instructor in order to be active in the links menu. There is also an opportunity to categorize the links in this part.

Figure 4.12: File Storage

Content part in the system has ability to present text, graphic, animation and so on. But some of the files cannot be placed in the content section. Executable files or SPSS data files are some examples. These files can be presented to the student usage in the files storage part. In the prepared system there are three folders in the files storage. Software, lab sheets and data files are placed into these folders. If there are created groups among the course users, group users can store their group specific files in this part.

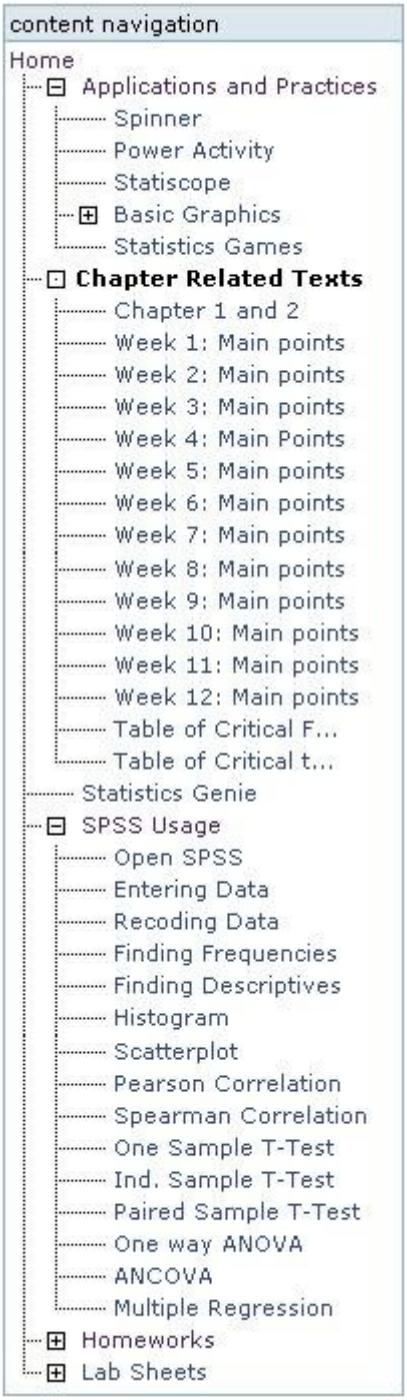


Figure 4.13: Content Navigation

As mentioned above content part has ability to present various materials such as text, graphic, animation etc. There are five categories at the beginning of the semester. Statistics Genie content has added at

the end of the semester because the students presented that they could not find easily this link during the interviews.

Applications and practices consist of practical applications located on other internet sites. This part can help students to learn better the statistical procedures.

Chapter related texts contain the important points emphasized by the instructor during the lecture hours. The researcher participated to the lectures in order to prepare the important points section.

Statistics Genie was the learners' need that they stressed. They wanted a wizard to tell the required analysis according to the variables that they have. So this part was provided in the content part.

SPSS usage part is another important part. The students provided the information that they can reach inadequate support from the internet about the usage of SPSS software. So this part was prepared by the researcher. SPSS usage includes the videos according to each of the analysis and interpretations of the results of the corresponding analysis.

Homework and lab sheets are provided to be reached easily. Students also provided the information that the lab sheets are causing some problems. So it is decided to provide these documents here would be better for the students.

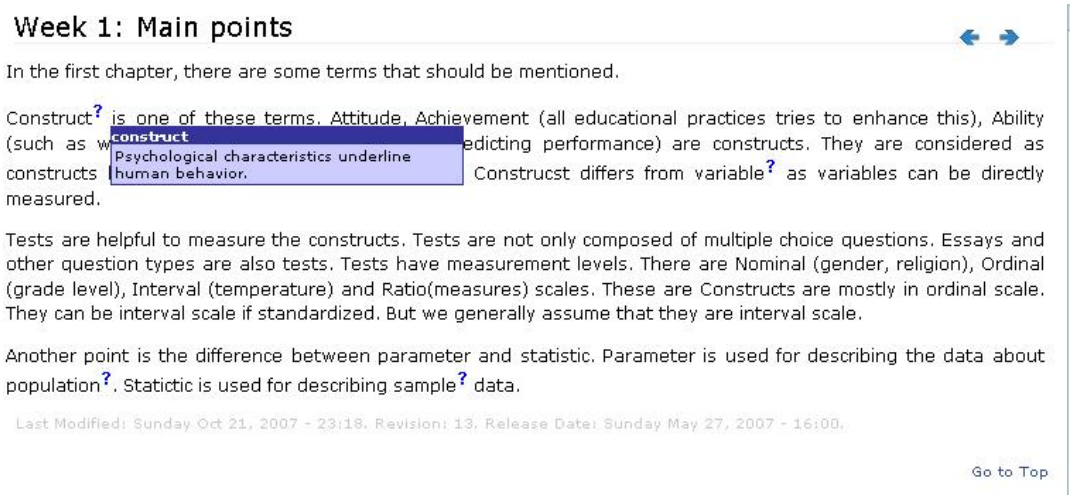


Figure 4.14: Main Points

For the content section, the instructor can easily prepare the content like using a word processor as showed in Figure 4.14. In addition some terms can be used from the glossary section. The terms used from glossary have a question mark next to it. If the user does not know the meaning of the word, simply mouse over the question mark, and reads the definition. This is usable as the user does not have to go and search for the meaning of the words. This eases the learning process.

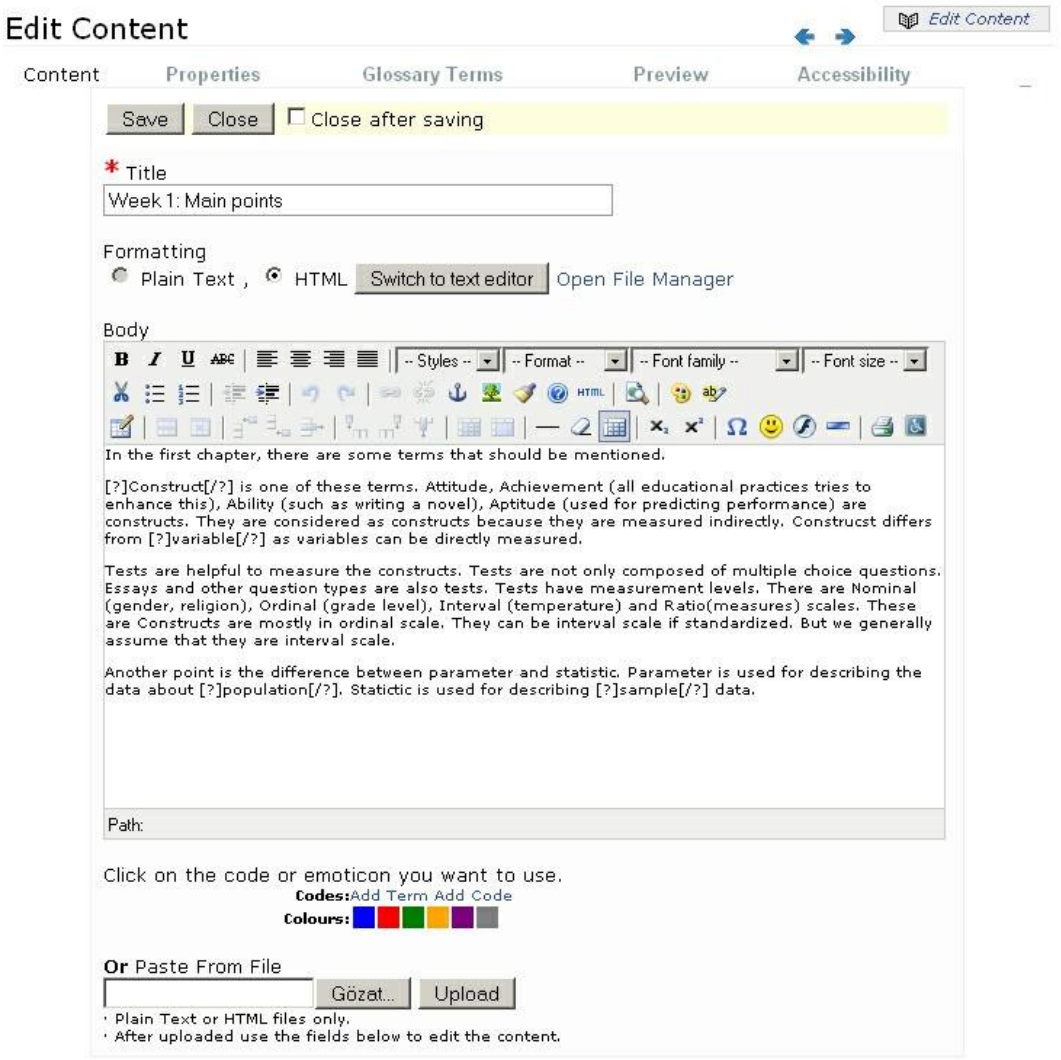


Figure 4.15: Content Editing

Contents can easily be edited like using a word processor or writing an e-mail. The contents can also be directly imported from a text or html file. Also there are many alternatives that the instructor can use while preparing the content. Key terms, release date, the order of the item can be arranged from the properties panel. Also there is an accessibility section which can be used for testing the accessibility of the prepared content. This can be used to see whether the content can be used from all types of devices or not.

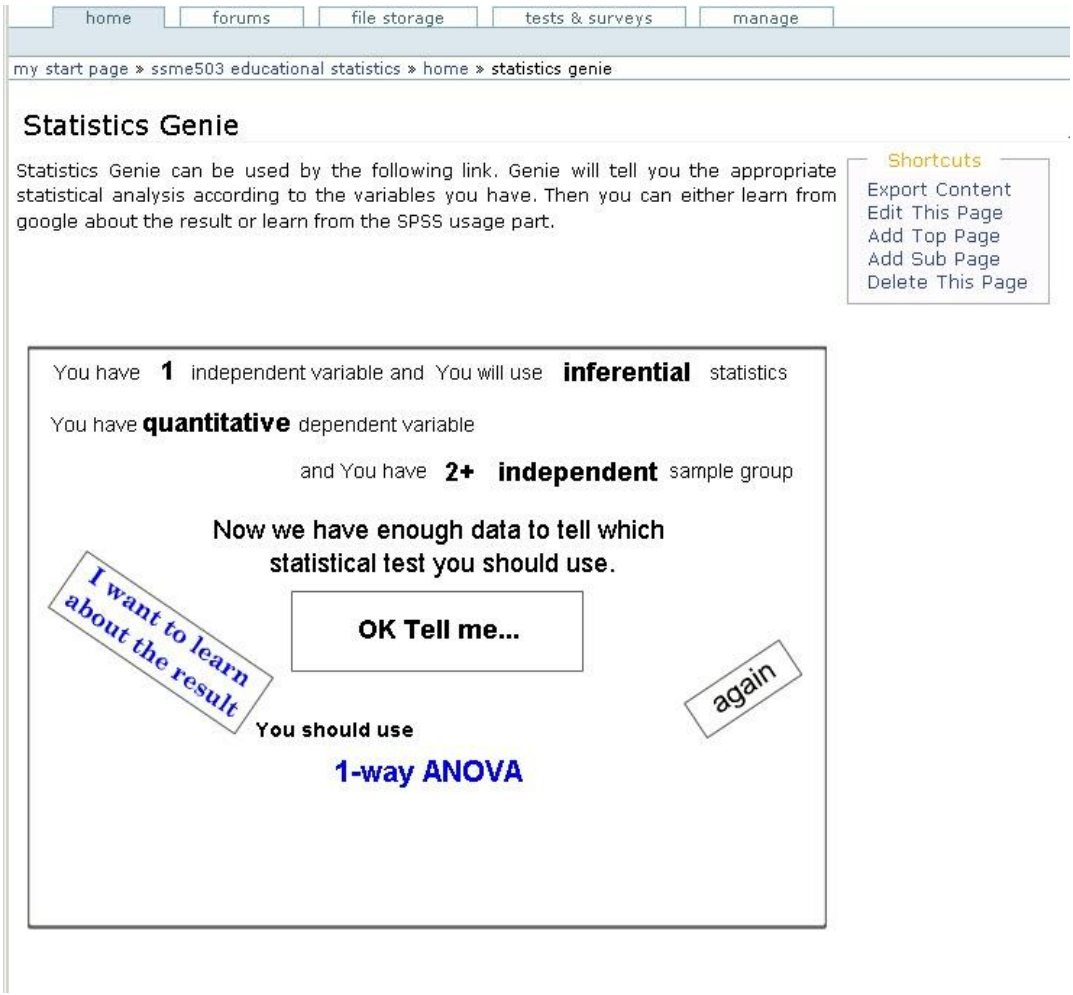


Figure 4.16: Statistics Genie

Statistics Genie is the first step for the learner in content part. The user first finds the required statistical analysis by using the statistics genie. According to the variables that the user has, statistics genie tells the required analysis. Then the user looks for the SPSS procedure of that analysis. The SPSS videos help the learner to see how analysis conducted.

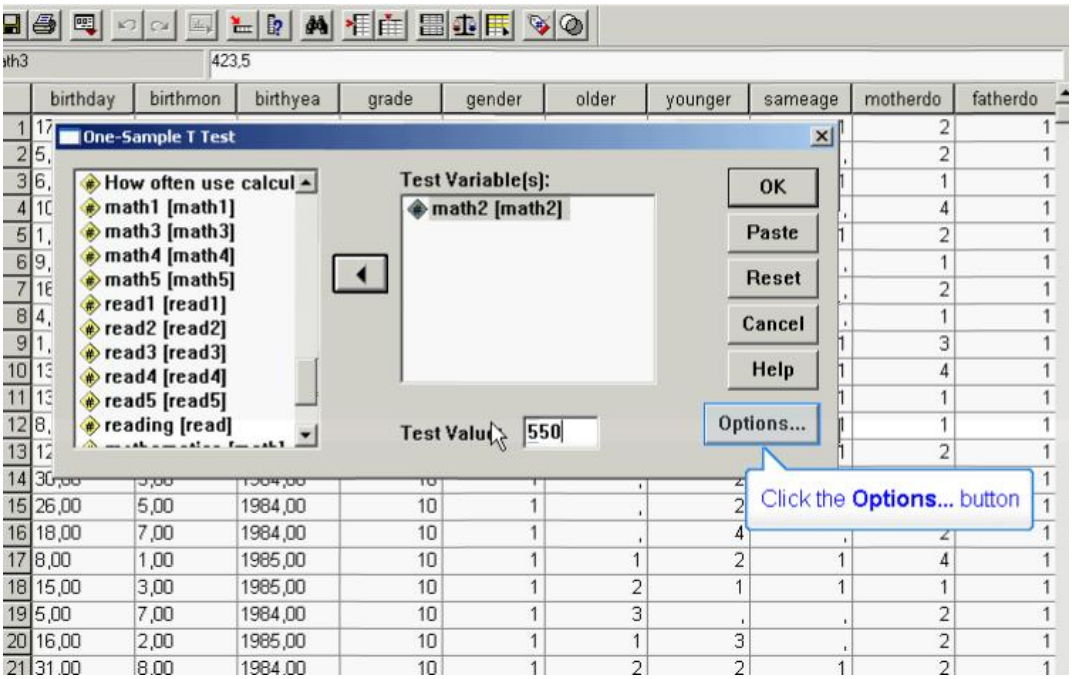


Figure 4.17: SPSS Video

There are SPSS videos prepared in the system. These videos show the related analysis step by step with visual aids. This will help easily remembering the analysis. Besides the videos also have benefits for the self-paced learning.

One Sample T-Test Video in SPSS.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
math2	574	558,43	87,917	3,670

One-Sample Test

	Test Value = 550					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
math2	2,298	573	,022	8,43	1,23	15,64

The One Sample t-test gives the table as above. The first table gives the sample size, mean and such value. The second table is more important. Test value is showed at the top. This is the given test value by the user. t value is the calculated value. df is the degrees of freedom. df is equal to (sample size)-1. 0,022 is the important point because it shows the significance level. as it is lower than 0,05 we can say that math2 mean is significantly different from 550.

Figure 4.18: SPSS Usage

The learner can learn the interpretation of the SPSS analysis results after watching the video. The result screen and the interpretation of the results were prepared as a content part, too.

Figure 4.19: Side Menu

Side menu is designed to ease the use of the system. As well as content part, forum, search, polls and other functions can be placed here by the instructor. The instructor can choose the order of the items as well as enabling or disabling it.

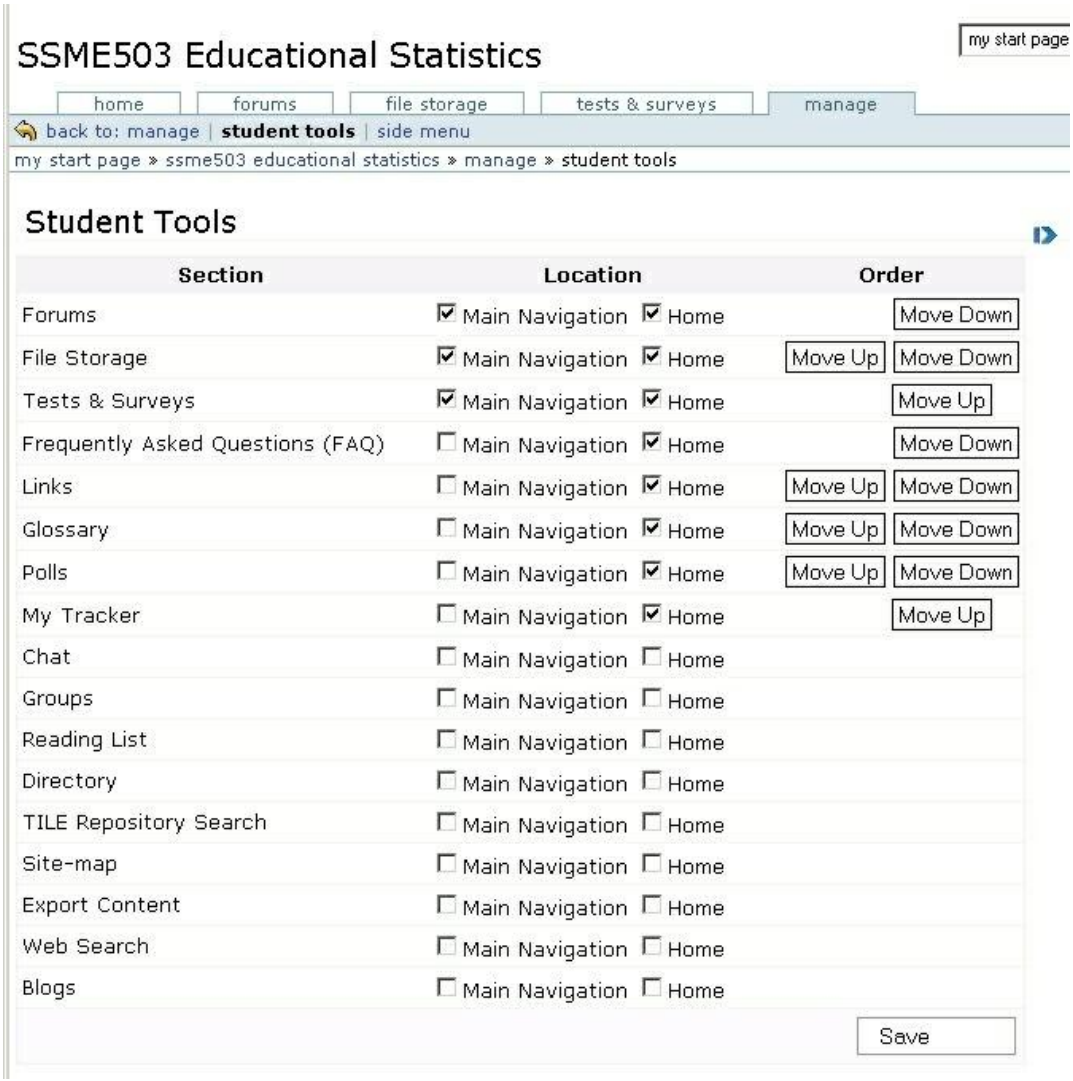


Figure 4.20: Student Tools

Student tools screen in the manage part is used for the instructor to define the available modules for the course. The availability and place to show can be defined in this screen.

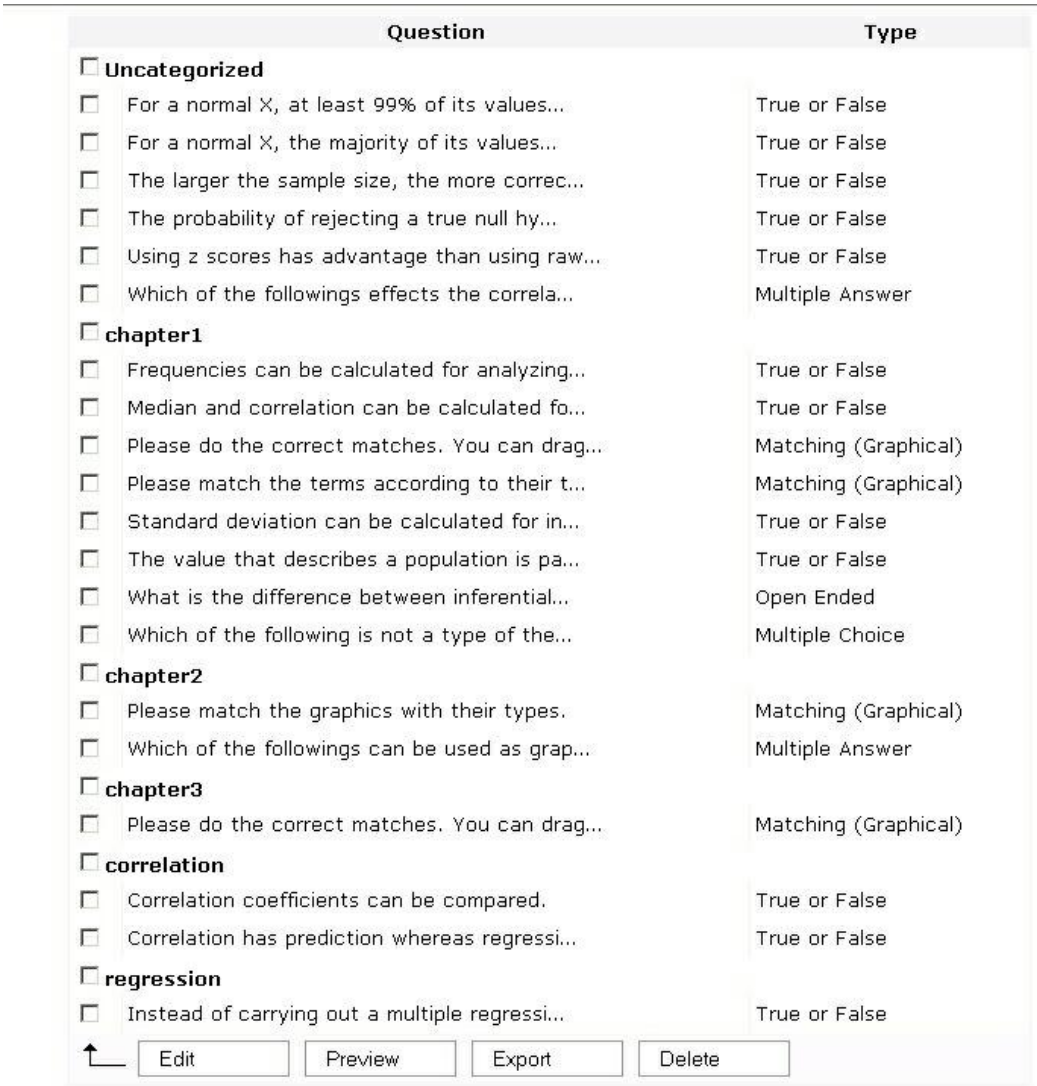


Figure 4.21: Question Database

Question database is an important part of the system. The questions are prepared first. The prepared questions can be used over and over again. There are many types of questions that can be prepared. Short answer, true-false, multiple choice, multiple answer, matching are the alternative types. Also some feedback for the questions can be added. These questions can be backed up and can be used in other systems as well.

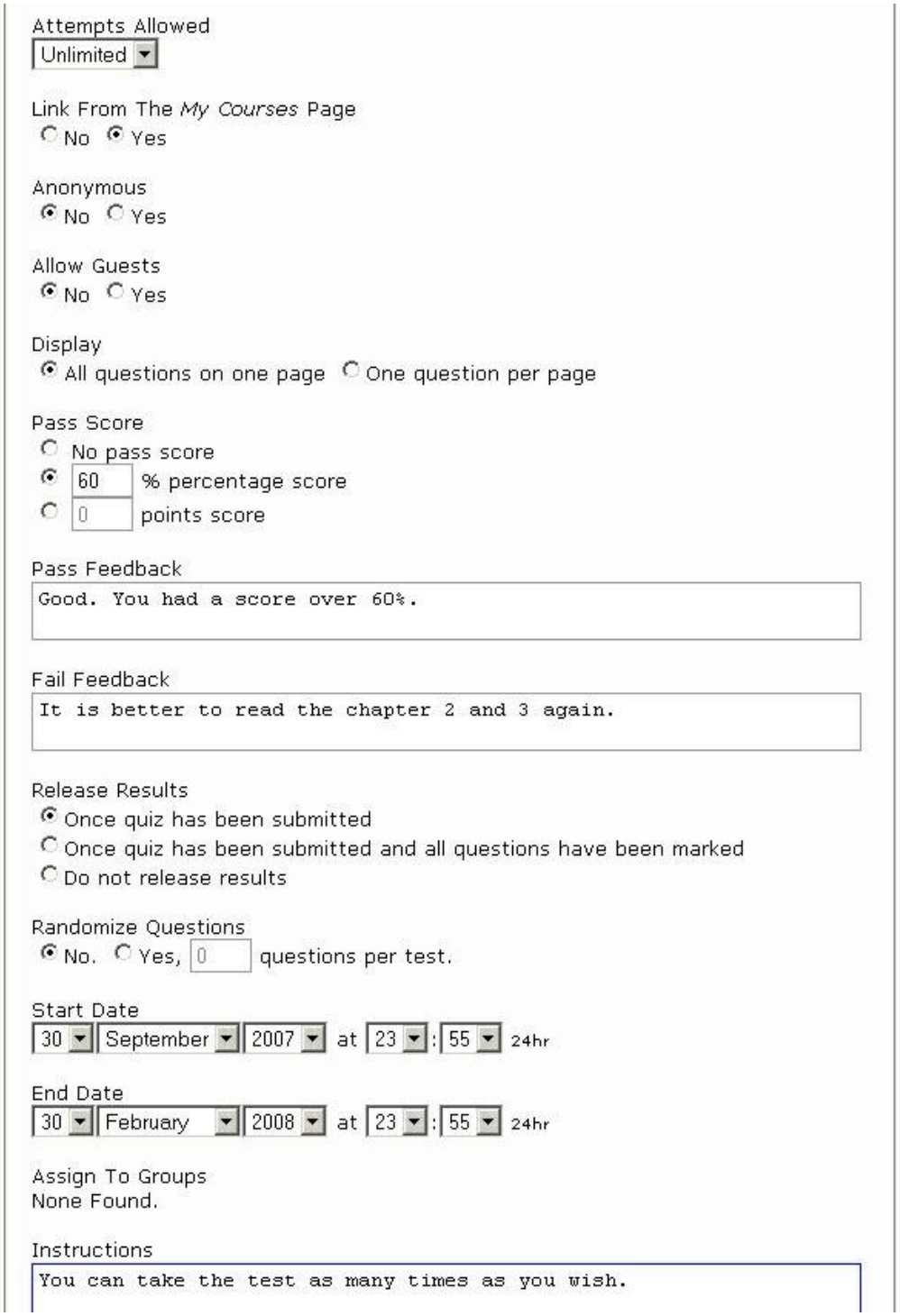
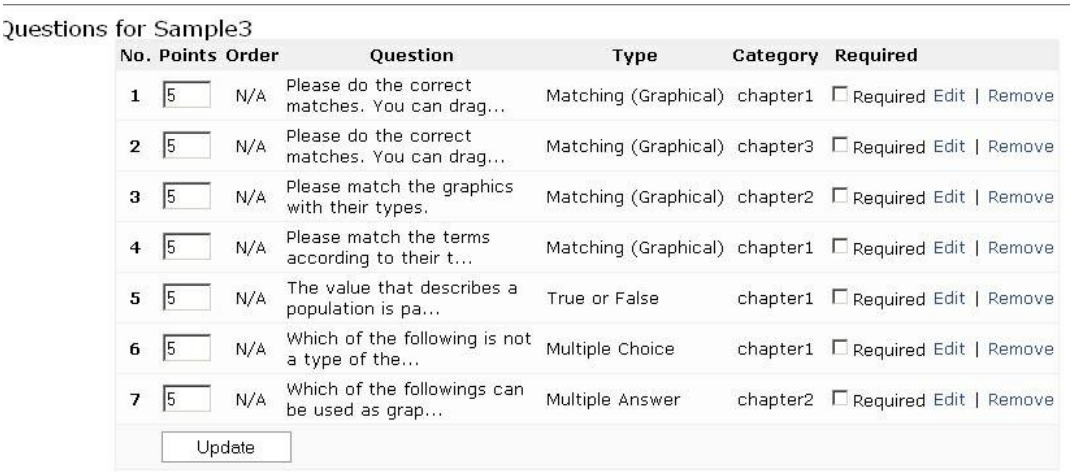


Figure 4.22: Edit Test Screen

Test preparation screen can be seen in Figure 4.22. Test preparation screen is used to define properties of the test. Some of these properties are:

- How many times the test can be taken by the students?
- If all of the questions will be presented in a single page or separate ones.
- Pass and fail scores and related feedback.
- The release time of the results.
- Randomization of the questions to prevent cheating.
- The start and finish time of the test.

The questions of the test are defined after the preparation of test properties. Figure 4.23 shows an example of questions page. The weights of the questions and orders (if randomization enabled) can be defined by this screen.


Questions for Sample3

No.	Points	Order	Question	Type	Category	Required
1	5	N/A	Please do the correct matches. You can drag...	Matching (Graphical)	chapter1	Required Edit | Remove
2	5	N/A	Please do the correct matches. You can drag...	Matching (Graphical)	chapter3	Required Edit | Remove
3	5	N/A	Please match the graphics with their types.	Matching (Graphical)	chapter2	Required Edit | Remove
4	5	N/A	Please match the terms according to their t...	Matching (Graphical)	chapter1	Required Edit | Remove
5	5	N/A	The value that describes a population is pa...	True or False	chapter1	Required Edit | Remove
6	5	N/A	Which of the following is not a type of the...	Multiple Choice	chapter1	Required Edit | Remove
7	5	N/A	Which of the followings can be used as grap...	Multiple Answer	chapter2	Required Edit | Remove

Update

Figure 4.23: Test Question Screen

4.6. Analysis of Data

The quantitative data were obtained by the results of Educational Statistics Mid-Term Achievement Test, Educational Statistics Final Achievement Test, and the records of support system. The data analyzed through descriptive methods. Simple correlation analysis was conducted among the examination results and the content usage statistics. SPSS software was used for this purpose.

Qualitative data were collected throughout the semester by means of observations and interviews. The researcher attended the lectures and laboratory hours to observe the difficulties and students perceptions. Besides the Constructed Web Site Perceptions Interview was prepared and used to interview the students.

Hoepfl (1997) cited the words of Bogdan and Biklen. Qualitative data analysis is defined as;

> "working with data, organizing it, breaking it into manageable units, synthesizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others"

In the newer book of Bogdan and Biklen (2007) some reliability and validity concerns had pointed as well as in the book of Büyüköztürk et.al. (2008). Although some authors have different names for reliability and validity in qualitative study, they are used as they are by some other authors.

The reason of this differentiation is the validity and reliability concepts are a bit different from the quantitative studies. These concerns also include the procedure of the qualitative data analysis. The points can be summarized as;

- Researcher should present the data as they are, without his/her interpretation. The interpretation of the researcher should be placed at the end.
- The collected data should be presented in detail with the strategies to obtain these data.
- The combinations of concepts should result with a meaningful whole.
- The findings should be supported with different resources and data collection strategies.
- Data collection procedure should be explained in details.
- If possible more than one researcher will strengthen the findings of the study.

Another important point is triangulation and it is important not only for qualitative studies but also for the quantitative ones. Different methods for data collections will strengthen the accuracy of the results of the study. In fact, the main point is to support the interview results with observation in order to increase the strength of the study.

All considered points except that conducting the study with more than one researcher was tried to accomplish in this study. The researcher had observations as well as interviews. Besides the used system recorded statistics of usage. The researcher cooperated with the instructor and assistants. The interviews were conducted in a neutral manner by the researcher and all participants were motivated to be truly honest about the questions. Then all data obtained was presented in the results section. After the data the researcher interpreted the data.

4.7. Assumptions and Limitations

4.7.1. Assumptions

Although the study was tried to be implemented perfectly, there may be some mistakes of the researcher that he was not aware of. To minimize the mistakes, the researcher was always in touch with the instructor and the assistant of the course. Researcher tried to communicate well with the students. As he did not want to rely on one survey or one examination, he tried to get the students' perceptions during the conversations. Also he wanted to overcome the difficulties of the students immediately so he continued to ask for possible problems that the students might face with.

4.7.2. Limitations

There were some limitations of this study. Most of the limitations were overcome during the preparation phase. Because the researcher's previous thesis (Emmungil, 2004) was revealed many limitations, and being aware of these limitations, the problems were solved before starting the study. These actions vary from having a dedicated server to having back up of the system.

The software and hardware obstacles were held in minimum level in this study. However there were some problems to have an appointment with some students. As some of them do not live in Ankara, the interview time could not be arranged with them.

Usage statistics are not so high in this study such as hundreds of usage in a day. This is a result of application strategy. As the instructor was not contributing much to the study in order to get more realistic results, the support system could not be integrated completely into the course. For example, the questions in the practice section were not

highly correlated with the examination questions. This caused less usage for that part of the site.

The study was limited to the one course during one semester. As the study includes observations and interviews as well as quantitative data, it would be very difficult to have different courses in different universities. In order to overcome this limitation, the researcher converted the system to a public course after the treatment procedure. By this way different people from different disciplines had a chance to analyze the system. The system has been improving according to the suggestions of public users continuously.

CHAPTER 5

RESULTS

5.1. Quantitative Data Analysis

5.1.1. Analysis of mid-term and final grades

"What is the effect of supportive web site usage on academic achievement of the students, related to educational statistics?" was the first research question. To analyze this question, formerly the assessments' descriptive data, then simple correlation analysis results will be presented.

Table 5.1: Descriptive Analysis of Grades

	Min.	Max.	Mean	Std. Deviation
Mid-Term	22	64	48,17	11,36
Final	30	94	75,50	15,60

The descriptive analyses of mid-term and final grades were presented in Table 5.1. The table shows a gradual increase in the mean for the Final Achievement Test. The minimum point increased to 30 from 22. Moreover the maximum point reached to 94 while it was 64 for mid-term. The gradual increase can be interpreted as the successive application of course support system. However the effectiveness of the constructed system needs to be analyzed further as well as the usage patterns.

5.1.2. Usage statistics of the site throughout the semester

The second research question was "What is the usage statistics of the site throughout the semester?" Below figures show the usage statistics of the course support site. Each figure shows the usage in one month during the semester. The site was closed to the guest usage on September 20, in order to keep the track of usage more appropriately. It was opened for anonymous usage again on 11 January. The instructor's usage is not included in the graphics. There was also a back-up system to support redundancy in case of connection problems to the main server. The statistics of the back-up server was also provided. But they are not considered in analysis part as the back-up server was open to public usage. Students were asked to use the back-up system if they have difficulties to use the main server.

These statistics is important for the instructors. The intensity of the usage will ease the decision for instructors and assistants to stay online to help students. This result will help instructor and assistants to spend less time to support online help for the students.

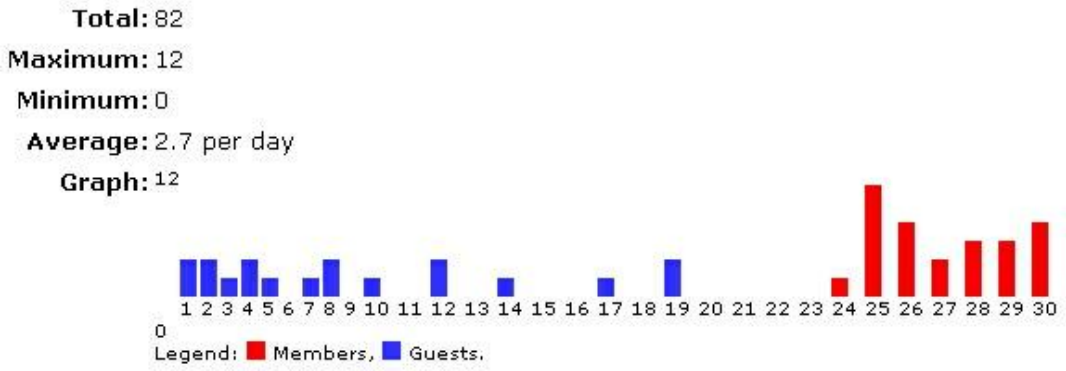


Figure 5.1: September

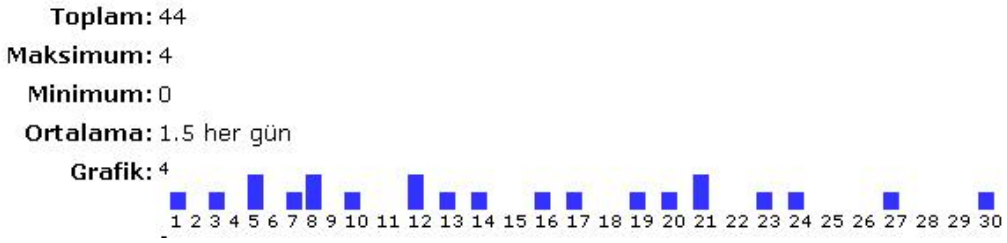


Figure 5.1b: September (Back-up system)

The lecture hours started at the end of September. The usage shows the students have analyzed the site. The second image (Figure 5.1b) shows the usage of the back-up system. A back-up system was also provided to the students in case of any obstacles to use the main site. They looked for the scope and learned the usage. There is no need for instructors to stay online in this period, because the site contains the Frequently Asked Questions part. In case of the need of an extra question from the students it would be better to use the site once or twice in this period. The person who will control the requests can also be an assistant.

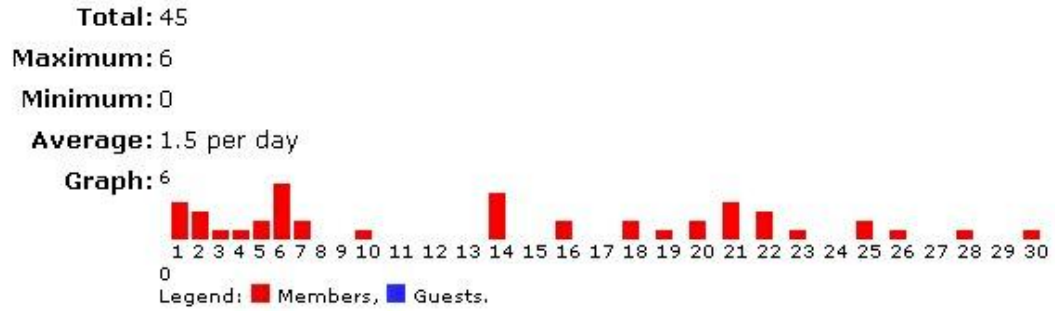


Figure 5.2: October

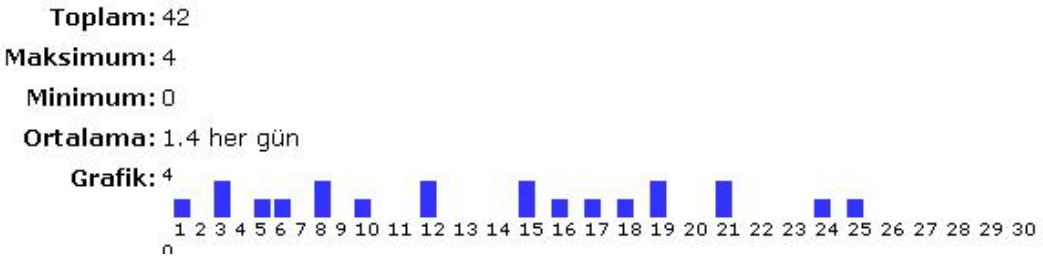


Figure 5.2b: October (Back-up system)

In October, there are random uses by the students. There was no exam in this month. The usage was mainly for learning the homework.

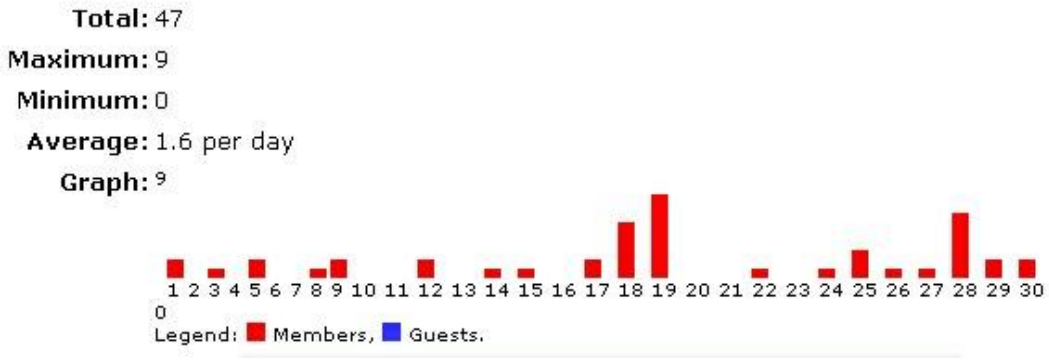


Figure 5.3: November

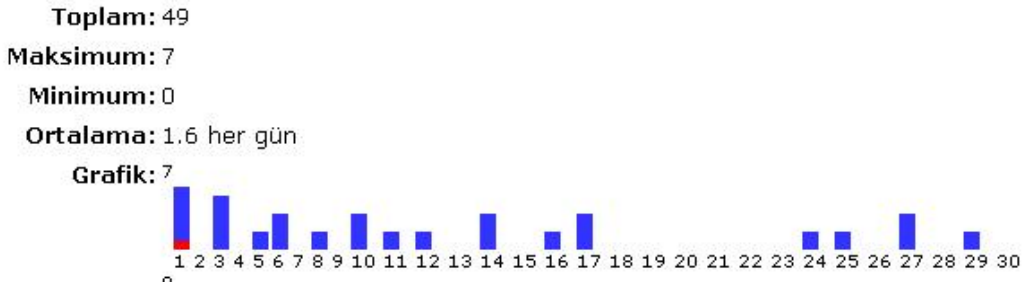


Figure 5.3b: November (Back-up system)

About November 20 there was Mid-Term Achievement Test. The usage of the site had an increase in those days. The usage intensity can be thought as three days before the examination. So it would be better for students to find an online assistant on the site.

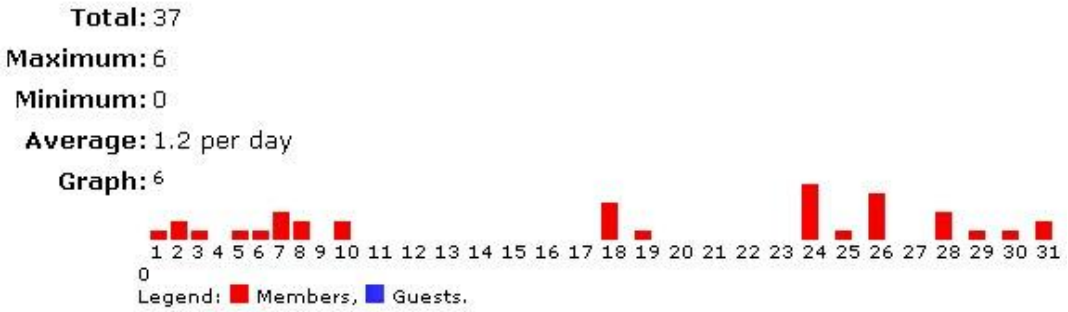


Figure 5.4: December

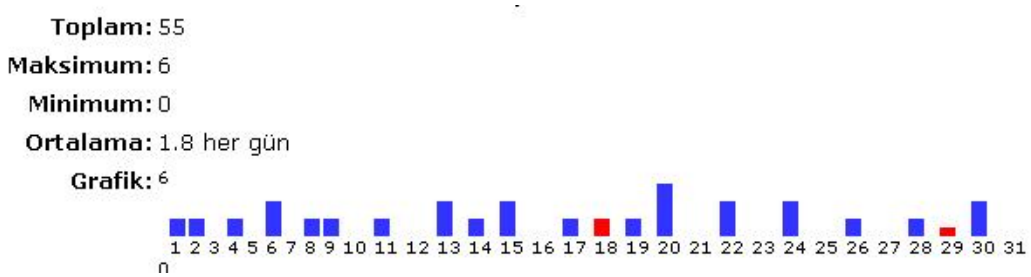


Figure 5.4b: December (Back-up system)

About December 31 there was take-home examination. This resulted to an increase in the site usage. The students had a need to communicate with their friends and the course assistants. But this time the usage period extended to a week. The assistant can be online one week prior to the due for the take-home examination.

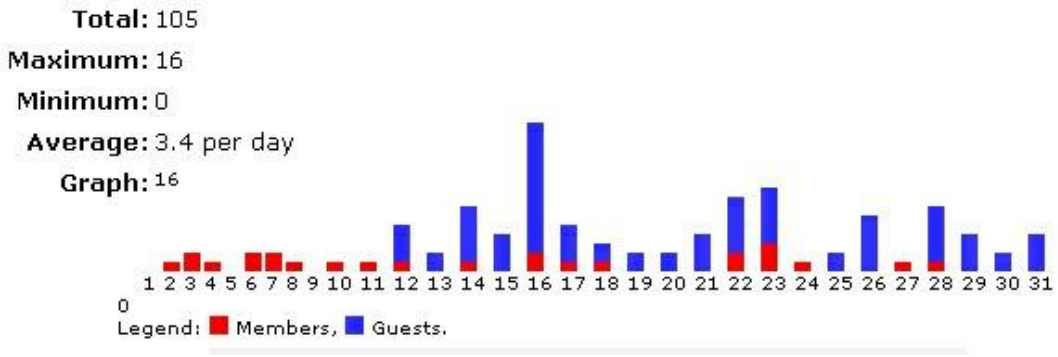


Figure 5.5: January

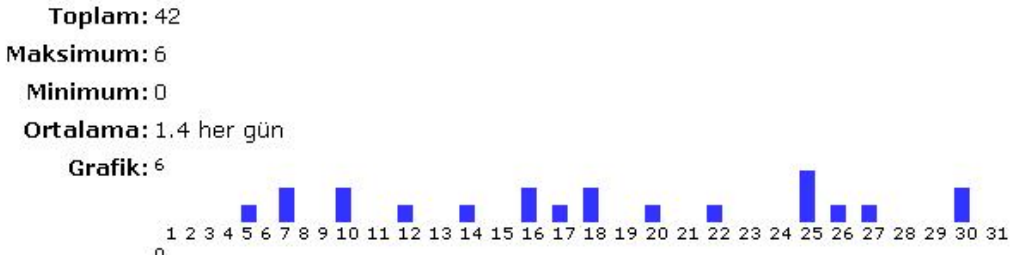


Figure 5.5b: January (Back-up system)

Examination results had announced on the site. So there was some usage on January. Besides, the Final Achievement Test held about January 9. This also had an effect on the site usage. At the end of the semester the system was opened for general usage. So there are blue points on the graph. As the students do not have to enter their identity any more, the blue statistics probably belong to the students.

As a conclusion for this part, site usage has an increase on some days before the examinations. So the instructor or assistant of the course does not need to be online during all of the semester in order to provide online help. Average of four days of online usage before the examinations will provide adequate support for the students.

In addition the statistics show that there is no need for high hardware requirements for web support for the course. Average usage is not so high, which means an ordinary server's hardware will be enough to online support for courses. This conclusion is important for the instructors who wanted to have course support system to be served by their own hardware. Even if the institution could not allocate a server for the system, the instructor can easily have the support system by own. It is crucial to remember that server machine have to have uninterrupted power supply and adequate air conditioning in order to run continuously.

5.1.3. Usage statistics of the content part

The constructed web support framework for the educational statistics course has the capability of recording usage statistics of the content part according to the username of the users. This option provided by the LCMS by default. Anonymous usage is not included in these statistics. These data will be analyzed in order to answer the third research question; "What is the usage statistics of the content part of the site throughout the semester?"

Table 5.1 shows the total usage of the contents by category. Chapter related texts had most visits. Applications and practices got the least hits. This table shows that the Chapter related texts is the most important part for the students. This section consists of summary that instructor considered in class. Especially his emphasized points were written in this part.

Chapter related texts part has another important point. Although in this study it was not controlled by the instructor, in real applications this part is the only part that should be directly controlled by the instructor. In this study this part was prepared by the researcher who attended the lecture hours and took notes of important points. In future applications it would be better these texts edited by the instructor, then added to the site.

Another important result presented in the table is the usage of SPSS videos. It took the second highest hit among top contents. Although the course has a laboratory section, result shows the need for the support for SPSS usage. That part contains SPSS application videos and basic explanations of result table interpretations.

Applications and practices got the least visits. This part consists of online available applications to practice or teach basic statistical

concepts. The result is there is not much need for practicing about basic statistical concepts. The applications were collected java applets on other web sites that freely available and prepared to improve learning. Java is a powerful programming language as Kampthan (1999) explained in his article. Like Macromedia Flash, it is used for creating interactive web applications. Again like Macromedia Flash with appropriate plug-in applications prepared with Java can be used in any browser in any computer platform.

Table 5.2: Usage of Content Categories

Page	Visits	Avg. Duration	Total Duration
Chapter Related Texts	161	0:30:49	4:54:08
SPSS Usage	101	1:16:26	8:22:59
Lab Sheets	84	0:55:39	8:20:44
Homework	78	0:29:07	5:48:22
Applications and Practices	73	0:17:25	2:19:50

Applications and Practices is the in the first order on the content part of the site. Table 5.2 shows the detailed usage of contents under the Applications and Practices heading. As mentioned above this part is the least used part among the other contents.

Table 5.3: Usage of Applications and Practices

Page	Visits	Unique Visits	Avg. Duration	Total Duration
Applications and Practices	26	15	00:00:23	00:10:06
Spinner	16	8	00:05:10	01:22:45
Power Activity	10	7	00:01:36	00:16:03
Statiscope	8	5	00:02:32	00:20:23
Basic Graphics	7	4	00:00:05	00:00:38
BarGraph Activity	2	2	00:02:06	00:04:12
Statistics Games	2	2	00:00:10	00:00:20
Histogram Sample	1	1	00:00:08	00:00:08
Histogram Activity	1	1	00:05:15	00:05:15

The most used content in the site is chapter related texts. The reason is the chapter related texts part contains directly the words of the instructor. Especially the students who did not able to attend the lecture hours of a week has an opportunity to see the emphasized points by the instructor, and then study especially those parts from the textbooks. Besides, this section is also important for the students to remember the important points of that week's lecture.

Table 5.4: Usage of Chapter Related Texts

Page	Visits	Unique Visits	Avg. Duration	Total Duration
Week 1: Main points	27	13	00:02:00	00:54:06
Chapter Related Texts	26	17	00:00:09	00:04:01
Chapter 1 and 2	23	14	00:02:45	01:03:31
Week 5: Main points	17	11	00:00:38	00:10:58
Week 3: Main points	14	10	00:00:28	00:06:33
Week 2: Main points	13	9	00:00:27	00:06:01
Table of Critical F Values	13	8	00:02:38	00:34:18
Week 4: Main Points	11	9	00:00:28	00:05:10
Table of Critical t Values	8	5	00:11:58	01:35:45
Week 8: Main points	2	2	00:03:51	00:07:42
Week 11: Main points	2	2	00:00:35	00:01:11
Week 9: Main points	1	1	00:00:18	00:00:18
Week 7: Main points	1	1	00:03:16	00:03:16
Week 10: Main points	1	1	00:01:06	00:01:06
Week 6: Main points	1	1	00:00:08	00:00:08
Week 12: Main points	1	1	00:00:04	00:00:04

SPSS usage part got the second highest number of visitors. In fact, this section is the in the first order in spending time. Students spent more than eight hours for this part. This result is not so strange because the SPSS videos take more time than the other contents.

Table 5.5: Usage of SPSS Usage

Page	Visits	Unique Visits	Avg. Duration	Total Duration
SPSS Usage	31	14	00:03:33	01:50:10
Open SPSS	12	9	00:00:59	00:11:55
Entering Data	12	9	00:01:37	00:19:33
One Sample T-Test	7	4	00:00:52	00:06:05
Recoding Data	7	6	00:03:17	00:22:59
Ind. Sample T-Test	7	4	00:03:35	00:25:08
Scatterplot	6	4	00:02:15	00:13:35
Pearson Correlation	6	5	00:00:18	00:01:51
Finding Frequencies	5	3	00:56:40	04:43:23
Histogram	4	3	00:01:14	00:04:56
Finding Descriptives	3	1	00:00:39	00:01:57
Spearman Correlation	1	1	00:01:27	00:01:27

Homework and lab sheets parts can be analyzed together (Table 5.6 and Table 5.7). Both of the sections also included in the file storage part of the site. Also these files were sent to the students via e-mails. Moreover, lab sheets were delivered as printed papers in laboratory classes. So it can be said that, if the usage would be restricted for the content part, both homework and lab sheets sections have higher statistics here.

Table 5.6: Usage of Homework

Page	Visits	Unique Visits	Avg. Duration	Total Duration
Homework	30	13	00:00:22	00:11:20
Week 3 homework	19	6	00:03:46	01:11:43
Week7 Homework	13	7	00:12:05	02:37:10
Week1 Homework	10	6	00:07:40	01:16:41
Second Midterm	6	4	00:05:14	00:31:28

Table 5.7: Usage of Lab Sheets

Page	Visits	Unique Visits	Avg. Duration	Total Duration
Lab Sheets	24	12	00:00:09	00:03:53
Lab Sheet 6	17	9	00:14:26	04:05:32
Lab Sheet 9	13	7	00:04:11	00:54:34
Independent T-Test	7	4	00:00:29	00:03:29
Correlation	6	4	00:22:40	02:16:00
Lab Sheet 7	6	4	00:00:21	00:02:06
Lab Sheet 8	5	4	00:08:54	00:44:31
One Sample T-Test	4	3	00:00:50	00:03:21
Lab Sheet 2	2	2	00:03:39	00:07:18

To sum up, except the applications and practices part, all of the content presented in the supportive web site can be considered as a must. These parts are chapter related texts, SPSS usage, homework and lab sheets. It is suggested by the author that the course instructor should decide keeping the applications and practices in the system as the course is originally offered completely traditional. So it can be necessary for other course support environments.

5.2. Qualitative Data Analysis

5.2.1. Perceptions of students about web supported instruction

"What are the perceptions of students about web supported instruction related to educational statistics course?" was the fourth research question. Perceptions about web site usage were collected through interviews. Participants were named from P1 to P15 according to the interview order. This is important for confidentiality.

5.2.1.1. The perceptions of students about the interface and usability of the support system

> "Have you ever used an online course support system?"
> "What do you think about the user interface of online support system for this course?"
> "Have you ever needed to change the interface language of the system?"

All participants except P10 and P15 used NetClass Course Management system before. NetClass has being used in Middle East Technical University to support courses. Every student has access to NetClass. If the instructor uses the system to present materials, the students are able to reach the materials. These materials can be chapter readings. Chat and forum part can be used in NetClass. NetClass started to support also online assessment.

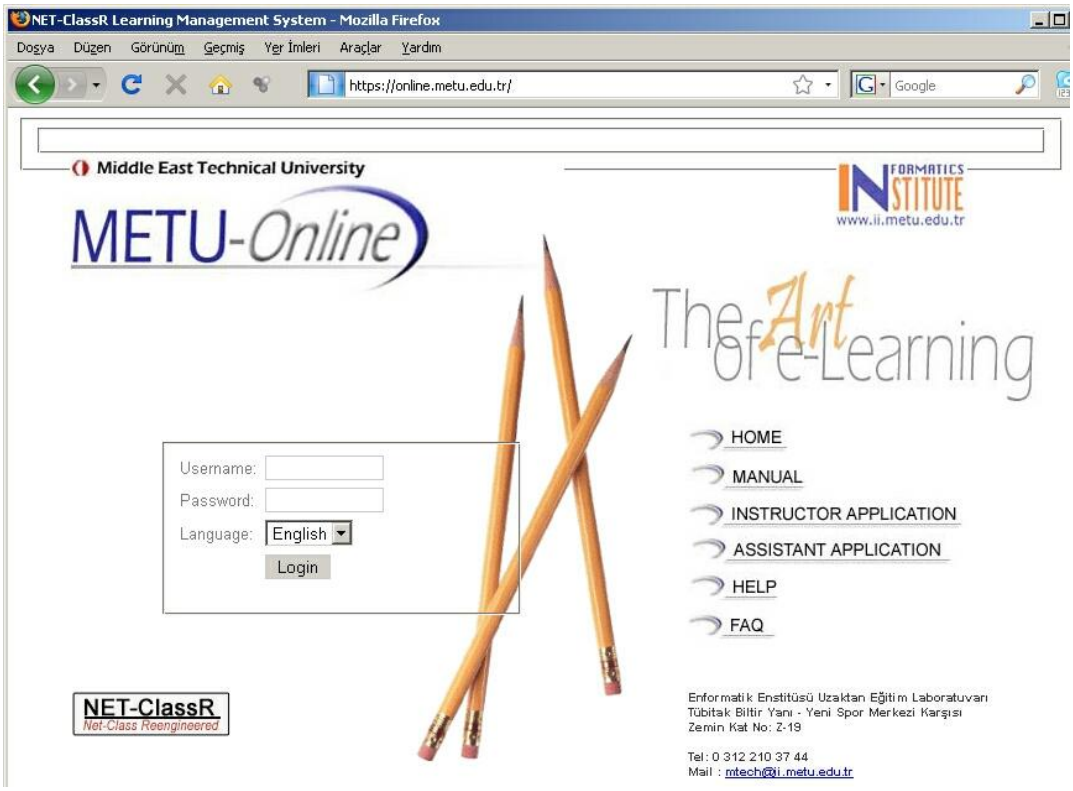


Figure 5.6: NetClass Main Screen

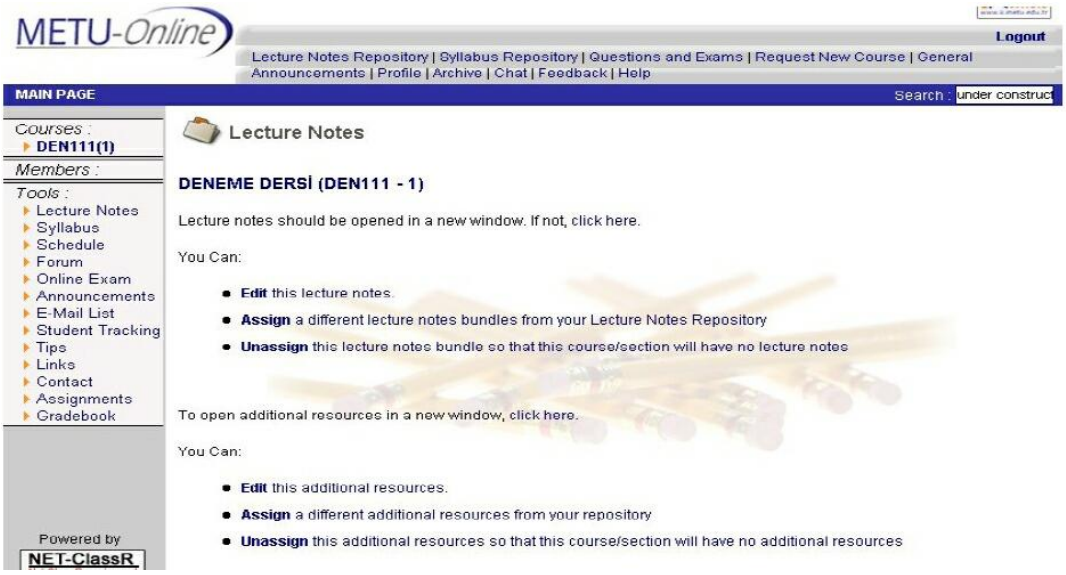


Figure 5.7: NetClass Course Screen

The participants were asked if they used NetClass, because researcher wanted them to compare course support system with NetClass. P1 and P9 have used Moodle LCMS too. Four of the participants (P1, P3, P7 and P9) had enough experience to compare the support systems.

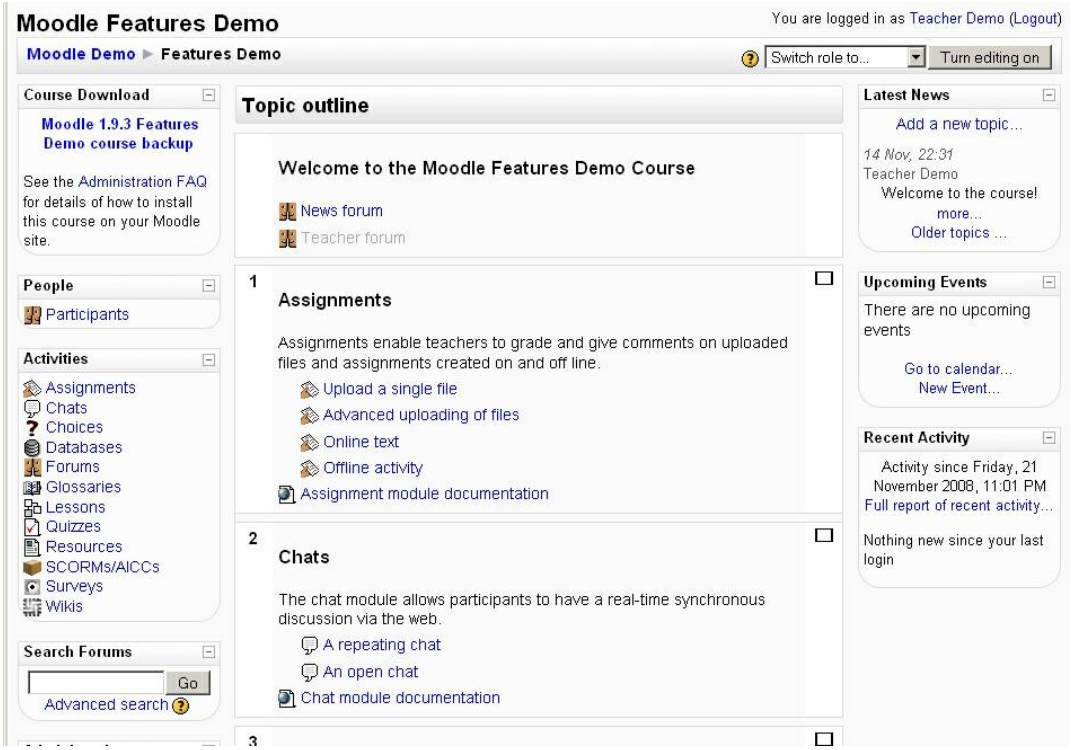


Figure 5.8: Moodle Course Screen

P1 said that “NetClass is not usable, its interface is not appropriate to be used, also content is limited in the NetClass system”. P3 also stated that “I do not like the interface design of NetClass”. P7 emphasized the search function. “NetClass do not have a search function inside. This is a big problem”. P9 said that “this system is easier than both Moodle and NetClass system.”

The system has an option to change the interface language. The options in the system were Turkish and English. As the language of the course is English, the default language was English too. The users asked if they ever need to change the interface language to Turkish. Only P7 stated that he used the system in Turkish. Other participants said that they did not need to change the interface language. In fact P12 and P14 stated that they prefer to use English as the interface language as the course is in English. P2 considered the interface language as a variable according to the institution policy.

Usability is an important factor for a successful study especially in technological one. P4 stated that she had a difficulty for the first usage. Also P11 said that “the interface was not attractive for me, so I did not want to use the system”. P13 stated that “I think these types of systems are not user friendly. Sometimes I have difficulties to use such systems.” Remaining thirteen participants mentioned the easy, simple, useful interface of the support system.

Table 5.8: Support System Interface Perceptions Summary

	LCMS Used Before	Turkish Interface Preference	Interface Perception
P1	NetClass+Moodle	No	Simple
P2	NetClass	No	Simple
P3	NetClass	No	Simple
P4	NetClass	No	Difficult for the first Usage
P5	NetClass	No	Simple
P6	NetClass	No	Simple
P7	NetClass	Yes	Simple
P8	NetClass	No	Simple
P9	NetClass+Moodle	No	Simple
P10	None	No	Simple
P11	NetClass	No	Not attractive
P12	NetClass	No	Simple
P13	NetClass	No	Simple but not user friendly
P14	NetClass	No	Simple
P15	None	No	Very simple
P16	NetClass	No	Simple

5.2.1.2. The students' perceptions about support system in terms of understanding statistics and related concepts

> "What is your opinion about the online support environment that was used during the Educational Statistics course that you have attended? Did it help you to understand statistical concepts?"

P1 stated the advantages of the system. "It helps me to understand the concepts better. Also I will contact easier with the instructor and assistants of the course. The most important point is ability to reach the information from everywhere. I cannot carry the course book, but I can reach the system from the internet". P2 interpreted the opinions about the system as "If there were more students coming from the other cities, they tend to use the system more. Also the instructor did not control the system. If the instructor directed the content, it would be needed more. Besides, I would prefer the solutions of the questions in the course book." P3 thinks that she is more comfortable with the textbooks. But she admitted that the internet is more practical to access the knowledge. P4 also thinks like P3. She prefers to listen to the instructor and use textbook. She does not think that she needs extra resources much. P5 said that "if the readings are short, the internet is more convenient. It is not easy to read long text from the internet." P6 combines both alternatives. "I use the internet while studying from the text book. Their functions are different according to me." P7 said that he looked for more basic knowledge in the site. P8 had positive attitudes about the support system. "The system decrease the study time with the textbook. I gain time by using the system. I prefer to use this system instead of textbook as much as possible." P9 prefers using textbooks. But he states that this system must be available, too. It is easier to access. Also it has opportunity for personal development. P10 prefers to use the system for the short information. "The system is better than textbooks for clear, short knowledge access." P11 said that "the textbooks are too long. When considering

the difficulties that I have with books, especially the chapter summaries would be good for me.” P12 got help during the learning period by means of the support system. P13 stated that “If there is such information rich system, it will be helpful not only during the semester but also in the future. It will provide information for the old students, too.” P14 pointed out that “It is great to have all resources in a single place. The system is very helpful. SPSS videos can be used anytime even in a restricted time. Besides, Statistics Genie provides immediate feedback about the correct statistical analysis.” P15 said that “It is necessary to repeat the statistical knowledge frequently. Moreover, it is hard to remember the procedure in the SPSS”. P16 commented that “The system will be helpful for the future use for me. For example I wonder if I can use such support system during the study period of my doctoral proficiency examination. Also I think I can use it during preparation of my thesis”.

Table 5.9: Help to Understand Statistical Concepts

P1	Communication advantage. System can be used from everywhere
P2	Students settled far from the campus will benefit more
P3	Prefer books, but the internet is more usable
P4	Prefer books
P5	System is more usable for short text
P6	Prefer books with the internet
P7	Prefer basic knowledge
P8	Time gains with the system usage
P9	Prefer books with the internet
P10	Better than books for clear, short knowledge
P11	Better than books
P12	Helped me to ease my learning process
P13	Helpful during the semester and for the future.
P14	Good to have al resources in single place.
P15	Good for practice.
P16	Usable for Ph.D. proficiency and during the thesis stage.

5.2.1.3. Students' thoughts about the system usage for computer laboratory sessions

"What do you think about the usage of online support system for the laboratory hours?"

P1 said "Course syllabus or homework should be delivered via this system. Beside, the laboratory session would be more efficient. The preparation phase for the laboratory sessions is very time consuming." P2 presented the idea of having laboratory sessions completely online. "Laboratory hours are very difficult to organize. Weekly program preparation is a problem especially for laboratory hours. With the use of this system, the instructor or assistants can support the sessions online. Finding convenient time would be easier for online lab hours." P3 also presented her idea as the more effective usage can be accomplished with the use of the system. P4 stated the problem of laboratory hours as "self-pacing becomes a problem for laboratory hours. Even for a person the other students have to wait most of the time. This system is convenient for self-pacing." P5 thought that the delivery of files for the laboratory sessions is time consuming. "Even for only using file delivery function; this system will increase the efficiency of these sessions." P6 stated similar opinions with P5. "File delivery is the biggest problem. Laboratory sessions are more convenient for personal studies. This system is better for the laboratory usage as it supports self-paced learning." P7 and P8 also mentioned about the problems of laboratory sessions. They preferred to study before the laboratory hours. P9 stated that "Laboratory hours are not effective. The system would be convenient if the student missed a lesson. Also sessions would be more effective." P10 mentioned "the lost lab sheets create problems. Also sometimes there are fewer sheets than the number of students. Also the site would be easier to reach after the course ended." P11 stated the effectiveness of SPSS videos. She said "It is very difficult to reach or to wait for the assistant. SPSS videos

would be very efficient for these sessions in order to cope with the pace of the assistant.” P12 said that she did not need the system in order to use during the laboratory sessions. She had all the necessary files in time. Even she had not had the files; she easily reached to the sources. P13 said that “I did not use the system during laboratory hours, but I live in another city, so I may not attend some classes. The system is very helpful for me in order to use it at home. I can have the necessary information of that week from the system.” P14 commented about the system as “the system can be helpful to have the necessary files. It is always a problem to wait for everyone has the files. As all of them are in one place we earn time. Another important point is unattended sessions. If I cannot attend the session of the week, I can learn the subject by means of the system.” P15 said that “of course the system is helpful for the laboratory hours. The biggest problem is self pacing during the practice sessions. By means of the system, self paced learning can be applied to the laboratory hours.” P16 stated that, it was difficult to have the previous weeks’ information. When there is a need for remember or study again the previous information, it is the best way to have such a system as it is always online.

Table 5.10: Usage for Laboratory Sessions

P1	Documents must be in the system
P2	Lab sessions can be completely online
P3	System would be more effective
P4	Has benefits for slow learners
P5	Prevents the problems of file delivery
P6	Prevents the problems of file delivery
P7	Opportunity to study before the session
P8	Opportunity to study before the session
P9	Good for the students cannot attend
P10	Good for future usage
P11	SPSS videos will help
P12	No need in laboratory
P13	Good for the students cannot attend
P14	Documents must be in the system. Good for the students cannot attend
P15	Has benefits for slow learners
P16	Good for remembering previous knowledge

5.2.1.4. The perceptions of students about Content part of the system which includes course main points, SPSS usage, worksheets etc.

"Content section was one of the main parts of the system. How can it be used to improve the understanding of statistical concepts?"

P1 stated the usability of reaching all support materials from one site. He liked to reach all of the necessary information in a single environment. P2 thought that the content part was usable especially for the laboratory sessions. P3 liked having the emphasized point during the lecture hours by the instructor. These summaries helped her during the study from the course book. P4 preferred to have the solutions of the homework in this part. P5 also said that "it would be better to have the solutions in the content part. Besides I would rather have the analysis videos of the data which were in the file storage part. By this way I can make practice easier." P6 stressed for the need of more example in the system. She thought that the content categorization according to subject matter would be better than it would be weekly categorized. By this way it would be easier to find the related information that she needed. P7 wanted to have categorization of content as "descriptive and inferential". P8 again stressed the need for the solutions of homework. She said that "Short weekly summaries are very useful. Online applets for practice are another good point to make practice and learn statistics better." P9 criticized the system as it should have more examples according to the examinations. He would rather get more benefits from the system by the examples about the examination questions. P10 stressed the importance of learning the assumptions. "It was good to have assumptions according to the each analysis. Also it is important to know when to use which analysis. The small software (Statistics Genie) tells the required analysis according to our variables." P11 liked the weekly summaries. They were very usable according to her. P12 thought that the weekly summaries can be more detailed. She added that it would have better if the instructor

completely managed the system throughout semester. P13 said that "The weekly categorized content may be converted to subject categorized. I did not use application and practices part. I think it is not necessary for me. Maybe the order of the topics can be changed." P14 emphasized especially the usage for doctoral proficiency examination. P15 commented that the content part is adequate for a support system and well organized. P16 said that "it is not necessary to have answers of homework, I think it can be used as a cheat medium. The process is important rather than the result. So everyone should do it by himself. In my opinion, the weekly summary part is the best part of the system. I think it is like the "pill of the week"".

Table 5.11: Usage of Content Section

P1	All resources in one place
P2	Especially for the Lab sessions
P3	Emphasized points of instructor
P4	Solutions for the homework would be better
P5	Solutions for homework and lab sheets would be better
P6	Emphasized points should be categorized, more examples can be added
P7	Content can be categorized as descriptive and inferential
P8	Summaries and applets are effective
P9	Contents should be more specific to the examinations
P10	Assumptions and method selection is good part
P11	Summaries are useful
P12	Summaries can be more detailed
P13	Emphasized points should be categorized
P14	Emphasized usage for doctoral proficiency examination
P15	Content part is well organized
P16	Summaries are useful

5.2.1.5. The students' perceptions about support system's test and survey part

"Test and survey part is a powerful part of the system. What do you think about its effect on learning statistics?"

P1 and P2 emphasized the importance of test section for practice. They said that it was the easiest way for self evaluation as the system gives immediate feedback. P3 stated that the questions were easy. The questions should be more complex. Also there should be more questions. P4 liked the test part and stated that "it would be better to have feedback at the end of tests as 'you should repeat this section'." P5 also stated that the test part is important for practice as P1 and P2. P6 preferred to have related questions at the end of each chapter. P7 stated the need for the test section. He also stressed the need to have more questions in order to practice. P8 preferred to have related questions at the end of each chapter like P6. She wanted to have more questions in the system. P9 needed the chapter related questions as well as practice questions. He offered to have sample data and its analysis in the questions. P10 stated the importance of test section usage before the examination. P11 said that "in order to use as a student the questions should be related to the examination." P12 stated that "I used and I liked the system. But I wanted more feedback for the questions that I have solved". P13 commented that the test section was important and necessary for practice. P14 said that "Test section is good. But I think tests can be homework and the questions can be related to the subject of that week. By this way the practice would be more beneficial." P15 said that there should be more questions. He said that "It is hard I know but hundreds of questions will be perfect for practicing. Each time the system serves new questions. By this way the system will be supporting the real practicing purpose". P16 commented that "the test section can be like TOEFL. If I know it should ask more challenging questions, but if I fail, it should serve easier ones. But it is

obvious that this is a crucial part for such a support system. Without independent practice, the course support cannot be a complete one. In fact the practice part is the most important part, I think.”

Table 5.12: Usage of Test and Survey Part

P1	Good for practicing
P2	Good for practicing
P3	There can be more challenging questions
P4	Good for practicing and results should direct to related subject
P5	Good for practicing
P6	Questions should be related to the chapter of each week
P7	I needed to practice. It can have more questions
P8	Questions should be related to the chapter of each week. It can have more questions
P9	It can have more questions
P10	It is better to use it before the examination
P11	Questions should be related to the examination
P12	Good but I want more feedback
P13	Good for practicing
P14	Questions should be related to the chapter of each week
P15	It can have more questions
P16	Good for Practice

5.2.1.6. The students' perceptions about communication parts of the support system

"How often did you use the communication alternatives integrated into the system? Which one do you prefer?"

P1 stated that "Assistant mostly should be online in order to answer to our questions. Sometimes it would be better to have the instructor online but it is not necessary for him to always be online. I think all of the communication opportunities should be integrated into the system because the most important function of the system is the communication." P2 thought that "as the course is in-class course it is not so necessary to use communication part. But when I have a problem I can use the chat part, or other messenger programs. It is better to have all three alternatives in the system." P3 also stated that all three communication alternatives should be available to use. P4 stated that she did not need to use the system for online communication. But she said that it was good to have these opportunities. P5 believes that the chat part is not necessary because the course had in class hours and also there were many people taking the course around her. But she thought that the forum and private message part were useful. P6 preferred to have all communication tools available. However P7 stated that "chat is unnecessary and can lead to useless conversations. So I think chat should not be available in the system." P8 also stated that chat is not necessary for their course. But she stressed that the forum part can be useful. On the contrary P9 believed that the chat function should be available because synchronous communication tools can be used for cooperative study. P10 stated that she did not need to use communication functions in the system. P11 said that "chat is unnecessary because we have course and laboratory hours. Everybody has different spare time. So I would rather to use forum part to communicate with my classmates." Both P12 and P15 stated that chat section will be useful to get support

immediately. They thought that it is difficult to have conversation by means of forum and mail functions. So the opinion is; it was better to have all three alternatives in the support system. However P13, P14, and P16 stated the opposite idea about the chat part. P13 think that the chat part did not have any benefit. P16 mentioned about unnecessary conversation and loosing time in the chat section. So the P13, P14, and P16 have the opinion to have only private messaging and forum part in the system for communication purposes.

Table 5.13: Usage of Communication parts

P1	Mostly assistant, sometimes the instructor should be online
P2	All three alternatives are necessary
P3	All three alternatives are necessary
P4	All three alternatives can be used
P5	Chat is not necessary
P6	All three alternatives are necessary
P7	Chat is not necessary
P8	Chat is not necessary
P9	All three alternatives are necessary
P10	I do not use any of them
P11	Chat is not necessary
P12	All three alternatives are necessary
P13	Chat is not necessary
P14	Chat is not necessary
P15	All three alternatives are necessary
P16	Chat is not necessary

5.2.1.7. Students thoughts about the poll section of the system

“There was also poll support in the system. How could it be used during the semester?”

Except of P6 other participants give positive feedback for the poll usage in the system. P6 thought that the poll section was not necessary for the Educational Statistics course. Other participants stated that it was good to have an integrated poll system. P2 said that “Polls can be used for taking decisions about the course related problems. Or the date of the examination can be voted.” P3 thought that poll system can be used to give feedback to the instructor. P11 and P13 thought as P2 about the poll system. They said it can be used to take common decisions. P12 also mentioned that the poll section was necessary as P15 and P16. P15 thought that it could be used to improve the content of the system according to the needs of the learners. P16 stated that it could help to improve the teaching and learning process. On the contrary P14 said that “it is not necessary because this is a graduate course and everybody has always an opportunity to present his/her ideas. Maybe it can be a useful function for undergraduate courses with more crowded lectures. ”.

Table 5.14: Usage of Poll Section

P1	Necessary
P2	Good to take the students' opinions
P3	Feedback to the instructor
P4	Necessary
P5	Necessary
P6	Not necessary
P7	Necessary
P8	Necessary
P9	Necessary
P10	Necessary
P11	Good to take the students' opinions
P12	Necessary
P13	Good to take the students' opinions
P14	Not necessary
P15	Necessary
P16	Necessary

5.2.1.8. Usefulness of file storage part for the students to get the files they need

"Did you need to use file storage section?"

Except of P3, all participants stressed the necessity of file storage section. P1 and P2 said it is important to reach to the course files easily. File storage section was usable as having various types such as SPSS data files. P5 wanted to have data files related to the data used in SPSS videos. P11 used the file storage part to reach to the examination results. P12, P13, and P16 mentioned about the importance of having the necessary files. The system had a function to easily access the files that they needed. P14 and P15 stated parallel ideas with the other participants as the section is a necessary. P15 added the idea of having the file upload access for the students. He thought that it would be better for students to share the files by means of the support system.

Table 5.15: Usage of File Storage Part

P1	Good to easy access to the files
P2	Good to easy access to the files
P3	I did not need to use
P4	Good to easy access to the files
P5	Files should be correlated with other contents
P6	Necessary
P7	Necessary
P8	Necessary
P9	Necessary
P10	This part is important
P11	I used for examination results
P12	Good to easy access to the files
P13	Good to easy access to the files
P14	Necessary
P15	Necessary
P16	Good to easy access to the files

5.2.1.9. Students thoughts about glossary and frequently asked questions parts

"Do you think that the glossary and Frequently Asked Questions part were useful for you?"

P1 stated that "I usually do not use the glossary or FAQ part of the sites." P2 said that "Glossary part is useful for the definitions of the terms but I do not generally use the FAQ parts." P3 stated that "both section is important. People should use the information about how to download files, how to change passwords, what do I have to do if I forgot my password etc." P4 thought like P2 as she liked the glossary part but did not need to use the FAQ section. P5 again liked the glossary section. She thought that it is important to have answers of the password related problems. P6 used both Glossary and FAQ section. She said that the more terms could be added to the glossary. Also she said that FAQ part is an important section for the easy use of the site. P7 thought that glossary is necessary but he does not generally use FAQ. P8 and P9 stated that both section is necessary for the ease of use of the site. P10 said that "I use FAQ for my first usage of a site. Glossary is of course necessary." P11 stated that she does not use FAQ part however she uses the glossary section. P12 like P11 did not use the FAQ part; she did not need to use, but she liked and thought that it is efficient for learning to have such part. P13 stated that glossary is necessary and he uses the FAQ part in order to reach the information about the course. P14 thought that glossary is necessary and it should have more terms and definitions. She also stated that "I use the FAQ part when I had an obstacle while I use the system". P15 thought that Glossary is necessary but he did not need the FAQ part. P16 also did not need the FAQ part, but he thought that the glossary part is good and it is good especially for technical terms.

Table 5.16: Usage of Glossary and FAQ

	Glossary	FAQ
P1	I do not use	I do not use
P2	Necessary	I do not use
P3	Necessary	Especially necessary for password problems
P4	Necessary	I do not use
P5	Necessary	Especially necessary for password problems
P6	Necessary	I look for this part
P7	Necessary	I do not use
P8	Necessary	Necessary
P9	Necessary	Necessary
P10	Necessary	I look for this part
P11	Necessary	I do not use
P12	Good and efficient	I do not use
P13	Necessary	I look for this part for the course related information
P14	Necessary	I use when I had an obstacle
P15	Necessary	I do not use
P16	Necessary	I do not use

5.2.1.10. Students thoughts about reaching the extra information they need from the links part

"Did you reach the extra information that you need from the links part?"

Except P11 all of the participants stated that the links section is necessary for the site. The extra information can be needed anytime and it would be much easier to reach the relevant information. P11, P12, P13, and P16 said that they did not use the links part. They did not need the extra information from the internet. On the contrary P14 and P15 stated that it is necessary. P15 added that it was good for the students to offer new useful links for the usage of his/her classmates.

Table 5.17: Usage of Links

P1	Necessary
P2	Necessary
P3	Necessary
P4	Necessary
P5	Necessary
P6	Necessary
P7	Necessary
P8	Necessary
P9	Necessary
P10	Necessary
P11	I did not use
P12	I did not use
P13	I did not use
P14	Necessary
P15	Necessary
P16	I did not use

5.2.1.10. Extra information provided by the participants

"Do you have any critics or suggestions for online support system that we did not mention?"

P1 did not consider any other idea about the site. P2 said that "all sections should be available even if it is not used. More sections lead more opportunity to improve the learning." P3 stated that "I prefer books, because books are more practical to use for me." P4 stated that test section should be used more frequently. P5 said that "I did not like the default interface. I like more colorful, more attractive interfaces. It is good to have the opportunity of changing the user interface for the site." P6 wanted to have more intensive information in the site. She liked the integrated sitemap into the system. P7, P8 and P9 liked the general idea of site construction. P10 liked the "statistics genie" section. But she offered to have more detailed chapter summaries in the content section. P11 did not state any extra information about the site. P12 offered that the users should be informed frequently about the new content or update in the system. P14 stated that she would prefer to have the search function in the upper because she had to scroll to use the search function. P15, like P10 stated that he liked the "statistics genie" section.

CHAPTER 6

DISCUSSION AND RECOMMENDATIONS

As an instructional technologist, the researcher believes that; no one is able to fulfill all of the requirements of students in order to provide the best education. There are many educational software in the market, but all those software offers a complete solution for the educational problems. Those programs created with the idea of creating a "magic wand" to overcome the difficulties of Türkiye's educational problems. But it can be easily seen that the "era of heroes" was over a long time ago.

If it is accepted that it is not possible to prepare a pill for all people in Türkiye, it will be the biggest improvement for the educational system. It is obvious that the needs of the students in one classroom differ from each other. With this fact it must be focused on providing individualized solutions instead of general ones. The researcher believes that the instructors have the most information about their students. So the teachers are the authority to decide the best way of instruction for the students. The researcher decided to provide a framework for the instructors. The instructor will be able to shape the framework according to the needs of his/her students.

The results of the 2008 households' usage of information technologies survey by Türkiye Statistics Foundation showed that the overall internet usage proportion is 24,5%. The study reveals that 87,2% of Turkish people who graduated from tertiary education have been using the internet (TÜİK, 2008). This result is very important in terms of web

supported instruction studies. This means that tertiary education can be the wisest starting point to analyze the effectiveness and perceptions about the web supported instruction. In this study the constructed framework evaluated by the graduate students. By this way the researcher tried to propose the easiest way of web support to the courses for the instructors.

Another important result of the TÜİK's study is the purpose of the internet usage. The study reveals that 76% of the internet users' usage purpose is reading newspapers or magazine. 74% used it to send or receive e-mails. Purpose of 70% was instant messaging. 65% used the internet in order to download or listen to music. The problem is there is no educational purpose of Turkish people during the internet usage. They like reading from the computer. They know usage of e-mail or instant messaging. However they did not think about using the internet for educational purposes. It is probably because of lack of high quality educational sites. The subject matter experts do not need to deal with the internet (Garfield, 1997), the computer experts do not need to deal with the educational sites. The proposed framework in this study is believed to fill this gap. The easy to use, easy to modify educational site will help to the experts about technology usage both for their courses and for lifelong learning of the community. The new trend for lifelong learning was mentioned in the introduction section as ubiquitous learning.

Other new information leads us to support ubiquitous learning is the increase rate in notebook sales in Türkiye. Notebook sales increased ten times in the last year (TÜBİDER, 2008). Also the wireless internet service is spreading. This means that we have the opportunity to teach everywhere. The idea comes from adaptive learning, which is the design philosophy of the framework that was used in this study as mentioned before. So the important point is the researcher believes that the easiest and the most economical way to improve the quality

education in Türkiye is designing such frameworks to help instructors with technology support.

The intended support was tried to create by help of ATutor, the content learning management system prepared with the adaptive learning environment in mind. The proposed framework is easy to use both by the instructor and the learners. In addition the system is capable of serving information to the learning for lifelong time.

The result of the study showed that there is a gradual increase in the academic achievement by support system usage. There are many studies parallel to the result that show the significant impact on the achievement by web supported instruction.

The qualitative data showed not all students need a supportive website. But also the qualitative analysis showed that it would be better to have such system for students to reach easier to the course materials, to practice, to gain further information, for communication purposes. Moreover as the system is a supportive web site and it is not a method of teaching, the quantitative data could not reflect the necessity of the system. In order to analyze the perceptions the qualitative data were collected during the study too.

The content of the support system was not prepared by the instructor. The researcher prepared the whole content. Although the weekly important points were taken during the lecture hours, the practice questions were prepared by the researcher, too. As mentioned by the participants, the questions are needed to be more related to the examinations. As presented in the quantitative analysis section, despite of the preparation of the content by the researcher, the site was used throughout the semester by the students.

As a result, when the web support system is used by the course instructor more, it would be highly possible to have even more effect on the academic achievement about educational statistics concepts. The researcher believes that the research showed the real need, the usage patterns and the intentions about the support system.

The site usage patterns of the system show that it is not necessary for the instructor to be online during all of the semester. The usage rate increases a few days before the examinations and returns to the previous level again after the examinations. This means that the instructor or assistants should be online to help students during the previous few days before the examinations. As the students are generally working or attending courses throughout the daytime, during the non examination period of the semester, evening time can be defined as online help hours like office hours. If there is more than one assistants of the course, it is better defining the help hours by the instructor. However the qualitative analysis showed that it is not so necessary for the students to have synchronous online help from the instructor or assistants as the course have in class hours. Also Koç (2002) cited the advantages of asynchronous communication from McIsaac & Gunawardena as;

- desirable access time,
- being able to think more,
- being able to read every message,
- being able to search about concepts,
- being more cost-effective according to the synchronous communication.

So the instructor can prefer to use forum part for the communication purposes. This means that anybody does not have to be online during a fixed time.

The communication part is one of the most important parts of the system. Content or files can be presented in printed paper, or videos

can be delivered via Compact Disk. Practice questions can be presented in either ways too. Links can be found via the search engines. But these are not possible for the communication part. Although there are some alternatives on the internet, those systems cannot be controlled by the instructor. Also unintended people can join those groups. There are mailing groups as an alternative for the communication. But those mailing groups have some disadvantages too. For example if somebody wants to receive a file, then he/she have to have that providers' e-mail address. Such problems lead us to provide a system to the instructor as a course support system which can easily be administered by the instructor.

Usage of content categories showed that "chapter related texts" part got the most number of visits. This result also shows the importance of administration of the system by the course instructor. This means the students needed mostly weekly summaries. Also during the interviews the participants stated that the weekly summaries were very useful. After that "SPSS Usage" part got the second highest hit. The laboratory sessions were difficult for the students as the assistants hardly have time to help all of the students. And also the SPSS usage is a practical area, the students needed to use SPSS videos. This result also shows that SPSS usage videos were one of the useful sections for the students. Although the "homeworks" and "laboratory sheets" parts used relatively less, having the same content in the file storage section can be a factor of less usage. However about 80 visits shows that these sections were also important for the students. "Applications and practices" had the least usage. The reason is thought as having simple activities there. The content usage analysis can be resulted as it is not so necessary to have "applications and practices" section in the course support system, but the other sections were used frequently and they are necessary for a support system.

To summarize this section we can conclude that:

- The course instructor should manage the course in order to get more benefit.
- It is better to use forum for communication purposes if the course has face to face lecture hours.
- One person (instructor or assistant) should frequently control the messages on the support system especially during few days before the examinations.
- It is important to provide main points, SPSS Usage, and related course files in the web support environment.

To mention about the qualitative analysis part; 16 participants were interviewed during the study. The participants were mainly from the Secondary Science and Mathematics Education Department. They are taking the Educational Statistics course as a must course in their graduate study. 88% of the participants used content or learning management system before. They are requested a comparison among the systems they used before. Again except of one participant found the used system as easy to use. One participant thought that it was not attractive. Only one participant used the interface of the system in Turkish (6%). Other participants stated that they used the system in English as it was the default interface language. One participant stated that the system is difficult for the first usage. As a result we conclude that the system is easy to use. Also the Turkish user interface is not a must for this course.

As a summary:

- Most participants have the experience about course support system before. (88%)
- The support system is easy to use. (94%)
- Turkish interface is not necessary for the Educational Statistics Course for SSME students. (94%)

General opinion about the course support system is positive as 94%. Only one of the participants preferred only books. Participants presented such advantages of the system usage:

- Time benefits; the system helps the students to spend less time to search and find the relevant information.
- Place independence; the system can be reached and used from everywhere. The system has more advantages for the students settled in other cities.
- The system is better for short information and summaries. The books have no search function.
- Practice opportunity help students as well as the instructor to monitor them about the learning process.
- The system is usable for preparing to Ph.D. proficiency and during the thesis stage.

The students had some trouble during the laboratory hours. The file sharing was a problem. Also the self pacing was an important factor for these hours. Participants thought that the system would be most useful for laboratory hours. All of the participants stressed the need for such system to use during laboratory sessions. The presented ideas can be presented as:

- Students can reach to the documents easier. The system prevents the problems of file delivering.
- Laboratory hours will be more effective.
- The system has benefits for slow learners.
- The system gives the opportunity for studying before the laboratory session.
- The system helps to the unattended students to the lesson.
- The system can be used in the future by the students who want to remember some points about the course
- SPSS videos are useful as the software menu has so many sections and options.

Question about the content part responded positively by the participants. There are many subsections in the content part. Practice, main points, SPSS usage, homeworks and lab sheets are the subsections. These are all mentioned as important by the participants. However content usage during the semester showed that the students did not frequently used the applications and practices part of the content section. So in the future usage of the system, the instructor has better decide to include or exclude the applications and practices section. The other sections of the content part are defined as necessary by both the participants and usage statistics. The important points for the content usage are:

- Applications and practices part has the least usage among the content sections which means that it can be excluded from the system.
- Weekly summaries are the most important part of the system. The instructor can decide to have weekly summaries or summaries for the topics.
- SPSS usage is very important especially there is no practice opportunity during the lecture hours.
- It is very useful to present course related files.

Test and survey part is a powerful part of the learning management systems. It gives great practice opportunity. Besides it is able to give immediate feedback to the learners. Participants also stated positive feedbacks for the test part. However there is a disadvantage for this study. The questions did not prepared by the course instructor. This caused that the questions were not highly correlated with the examination question. This was the critic of the participants during the interviews. The results are:

- Test and Survey section is good for practicing.
- Some of the questions should be directly related to the examinations.
- There should be many different types of questions.

- Preferably the questions should be prepared by the instructor.

There were there alternative means for communication in the system: Private messaging, forums and chat. Participants were asked the necessity of these alternatives. For the Educational Statistics course chat is said to be unnecessary by the five of the participants and necessary by the six of them. This decision changes up to the instructor. If the conversations can be controlled by a person who will be frequently online, then the chat part can be used. If not it is better to disable the chat function. Another point is the presence of the instructor or one of the assistants to reply the questions in the system is important. As a result for the communication functions:

- Private messaging is usable for one to one communication. (94%)
- Forum part should be available for asynchronous communication. (94%)
- Chat part considered as necessary by the half of the participants. (%50). The other half of the participants are against to have the chat section. So the result is; chat part can be available if a person will be frequently online to control and reply the questions synchronously. Otherwise it is better to disable it.
- The instructor or assistant(s) should sometimes check the messages in the system.

Poll section is a good way to collect the opinions anonymously. All of the participants stated that it is necessary except two (88%). To take students opinions, to have feedback from the students it would better to use the poll section.

- To take students opinions
- To vote for a decision
- To give feedback to the instructor the poll section can be used.

File storage part is useful especially for the courses which require different types of files. Educational Statistics course is an example which requires students to use SPSS data files, SPSS output files, word processor files, data sheets etc. File delivery was the biggest problem for the course.

- File storage part is necessary for SSME 503 course. (94%)
- File storage part eases the access to the files.
- The section helps especially students who study on different computers.

Glossary, Frequently Asked Questions, and Links sections were not used by the students frequently. Glossary was said as necessary by the ten of the participants. Five of the participants did not used FAQ, and only two participants stated that they were looking for this section in the sites. The technical questions or general ones should be located in the FAQ section. It would be difficult for the instructor or assistants to answer the technical or general questions repeatedly. The links part consists of external resources. It was defined as one of the necessary parts by the participants. The important points of usage of glossary, FAQ, and links parts are:

- Glossary should be available as there are many new terms about statistical concepts (94%).
- FAQ may not be used by some of the users, but it is better to have in the system as it replies the general questions and decreases the workload for the instructor. 50% of the participant used the FAQ section.
- External resources should be listed in the links part. (75%)

This study was conducted in order to create a technology support framework to improve the students' learning and to decrease the effort of the instructor to prepare a web support environment for the educational statistics course. The infrastructure was an Open source and freely available LCMS, ATutor which can be used and administered

easily. The contents can be used over and over again by the instructor without any extra effort. The content package is SCORM compliant which means that the package can be exported and used in any alternative systems. The content can also be easily changed or updated.

So the researcher believes that this study will help the instructors of the Educational Statistics courses with a constructed web support framework. It will help the students to easily reach and use course resources from wherever they want. Students will also have more practice opportunity whenever the need. The system may also help to decrease the need for the printed course materials.

For the future researches other subject areas can be studied. Web support systems can be prepared and analyzed for other courses. These studies may be considered as a support for OpenCourseWare (Opencourseware, n.d.) projects which motivate the educators to share the educational support materials. The web support systems can be used as a starting point for the distance education.

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APPENDIX A

DEFINITIONS OF TERMS

Asynchronous Communication: Students and the instructor can get onto the system at any time they want, post their discussion, comments or opinion for others to view later. (Xiaoshi, 2000)

Interactive Learning: Specifically defined as a process of involving some form of digital mediation between a teacher or designer and a learner. (Reeves & Hedberg, 2003)

Computer Based Assessment: Usage of computers in order to elicit performance of the learners. In recent years it can be considered as Computer Adaptive Testing.

Course management System: CMS is a flexible, integrated environment where students can use the latest technology to foster inquiry, encourage discourse and inspire collaboration. Meanwhile, CMS allows instructors automatically to control the progression of an online class through the course material delivery and evaluation, interactivities with their students as well as online student information system application. (Xiaoshi, 2000)

Learning Content Management System (LCMS): The support system in class courses with online materials.

Learning Management System (LMS): The system that is used to offer online courses.

Synchronous Communication: The communication system that both students and the instructor are logged into a system and communicate with each other at the same time. (Xiaoshi, 2000)

Web-Supported Instruction (Also called as Web-based Instruction or Web-aided instruction): Web support to a traditionally delivered course with a web site, which includes resources of the course (LeJeune and Karen, 1998). In this research the supportive web site is represent for the site that was used throughout the study.

APPENDIX B

CONSTRUCTED WEB SITE PERCEPTIONS INTERVIEW

Bu görüşme Levent Emmungil'in doktora tezi kapsamında oluşturulan Yüksek Lisans İstatistik dersi destek sistemi ile ilgili görüşlerinizi öğrenme amacıyla gerçekleştirilmektedir.

1- Daha önce NetClass, Moodle veya benzeri bir sistem kullandınız mı?

2- Ders Destek Sisteminin arayüzünü nasıl buldunuz, sizce rahat anlaşılır ve kullanışlı mı? Arayüzü Türkçeleştirme seçeneğine hiç ihtiyaç duydunuz mu?

3- İstatistiği ve ilgili kavramları anlama açısından ders destek sistemi ile ilgili görüşünüz nedir?

4- Laboratuvar saatleri için siteyi kullanma ihtiyacı hissettiniz mi? Eksik kaldığınız noktalarda size yardımcı oldu mu?

5- Sayfanın sağ bölümünde İçerik gezintisi (Content navigation) bölümü bulunmakta? Etkileşimli uygulamalar, Haftalık özetler, SPSS kullanımı ve ders materyalleri (ödevler, çalışma yaprakları) bölümleri hakkında düşüncelerinizi açıklar mısınız?

6- Test bölümü ATutor'un en kullanışlı bölümlerinden biridir. Test bölümü için neler söyleyebilirsiniz?

7- Forum bölümüne ihtiyaç duydunuz mu? Katkı veya yardım amaçlı mesaj yazmayı düşündünüz mü? Anlık iletişim (Chat) bölümü olmasını

tercih eder miydiniz? Bunun yanında iletişim amaçlı olarak Gelen kutusu (Inbox) bölümü ile ilgili fikriniz nedir?

8- Anket (Poll) bölümü hakkında ne düşünüyorsunuz?

9- Dosya deposu (File storage) bölümünü kullandınız mı? İhtiyacınız olan dosyalara kolay ulaşabildiniz mi?

10- Sözlük (Glossary) ve Sıkça Sorulan Sorular (F.A.Q) bölümlerinin faydalı olduğunu düşünüyor musunuz?

11- Bağlantılar (Links) kısmındaki sayfalardan ihtiyacınız olan bilgilere kolay ulaştınız mı?

12- Sistem ile ilgili bunlardan başka eleştiriniz veya öneriniz var mı?

Çalışmamıza yaptığınız katkıdan dolayı teşekkür ederiz.

APPENDIX C

COURSE SUPPORT FRAMEWORK INSTALLATION

The installation of the course support framework is easy and does not require much technical knowledge. However this procedure requires some basic knowledge about web and database servers. This basic knowledge can be learned from the manuals of these software. In order to install to an ordinary computer that is not a server, “xampp” or “easyphp” package programs can be used. The software prepares the computer as a web and database server. Then the learning management system files is downloaded and placed to the folder of web sites. In this case the LCMS is the ATutor LCMS which was used in this study.

Figure C.1: Control Screen

The first step is controlling the system requirements. If there is a missing component the control mechanism informs the user and the installation cannot begin. As the LCMS has dynamic web pages written in PHP, PHP support is required. Because the data are placed in the database server MySQL server is required. The components are controlled and found relevant as can be seen in Figure C.1.

Figure C.2 shows the License agreement page. In order to continue the terms of usage must be agreed. ATutor is an open-source software. ATutor license is one of the open-source licences; General Public Licence (GPL) which means the software can be analyzed and used by anyone. Even it is free to change the codes and/or sell the software unless the license remained GPL. The development of open-source software is not limited to a group of coders. As the codes are public, the developers are much more than non open-source software. So the development of an open-source software is faster and more reliable.

Figure C.2: Terms of Use

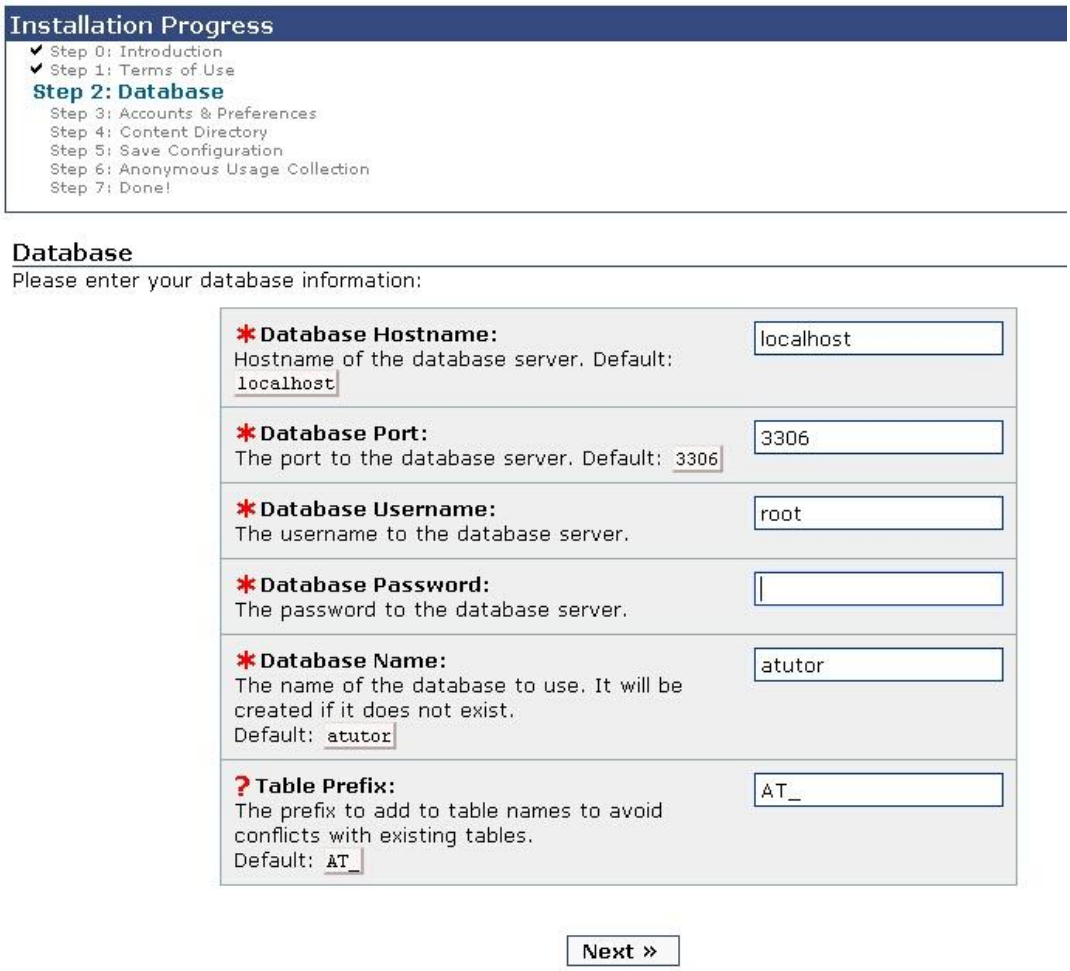

Figure C.3: Database Configuration

Because the system needs a database and the database configuration can be changed according to the server, database information is required in step 2 as in the Figure C.3. Usually the default password of the database is blank. Of course this should be changed in public systems.

Figure C.4: Creation of Tables

Right configuration leads successful creation of tables. There are many tables as there are many functions. If the tables cannot be created the installation will not continue with the next step.

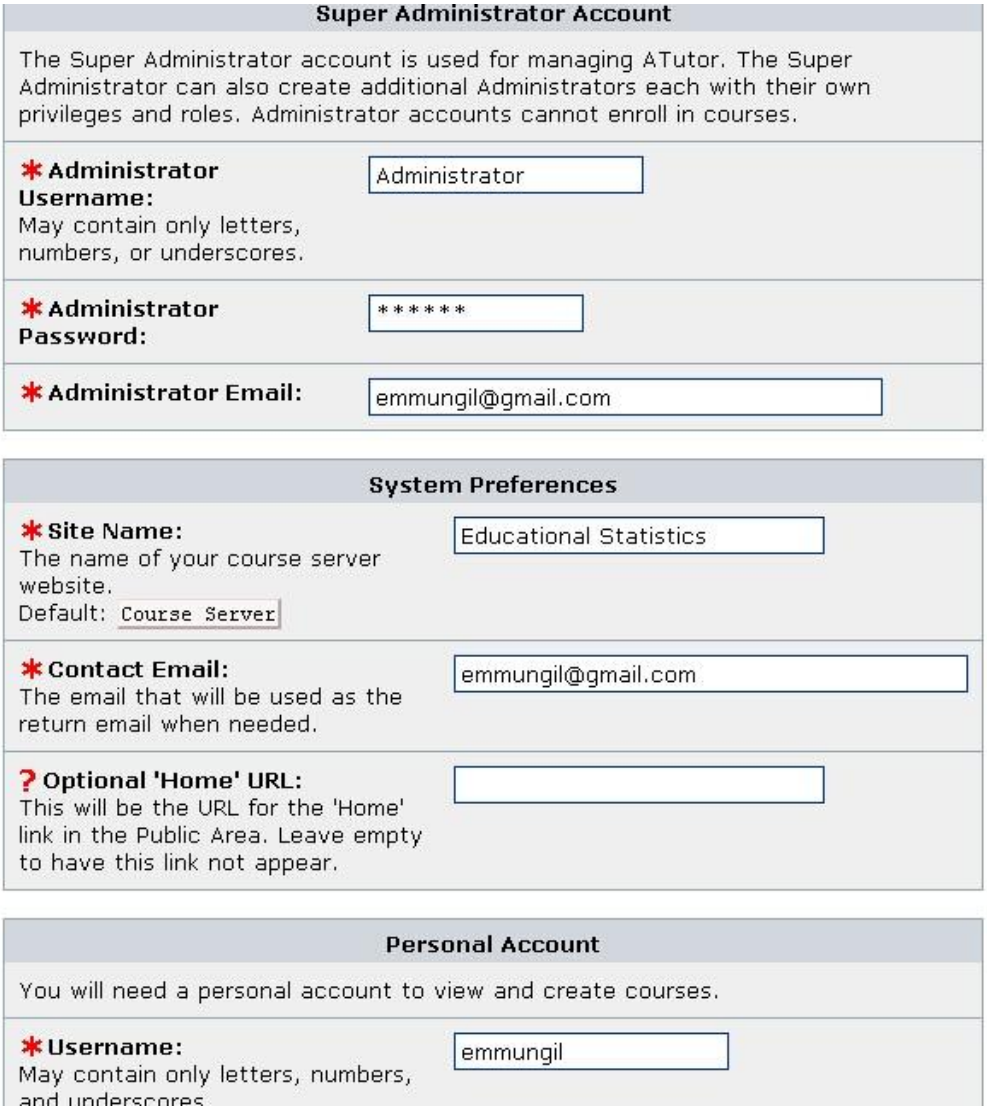

Figure C.5: Creation of Accounts

The next page stands for configuration of the users and passwords. The super administrator account is important as the user has the complete privileges over the system. Another account for the instructor is created in this page too.

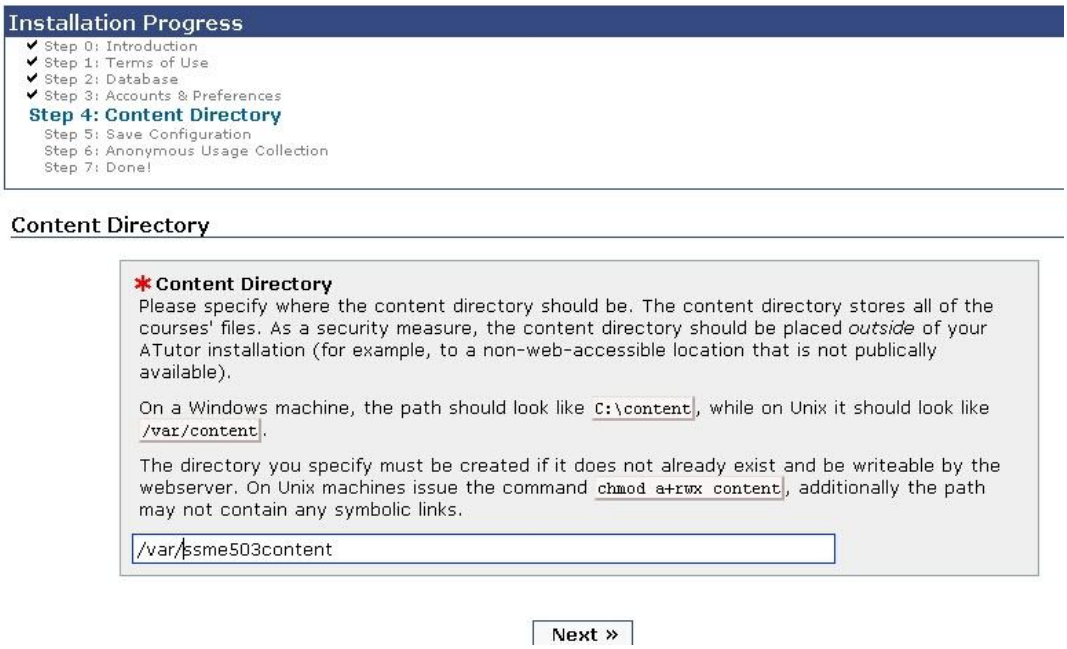

Figure C.6: Creation of Content Directory

Content directory required to place the course materials. As these materials should not be reached from the internet directly, the directory is placed outside of the web folders.

Figure C.7: Last Step

The configuration is written to the config.inc.php file. On Linux systems it is necessary to change the permission as it is not writable by default. The page in Figure C.7 shows the anonymous usage collection to improve the system. The installation procedure was completed. The system is ready to use.

CURRICULUM VITAE

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ODTÜ G.V. Özel Okulları (2001–2002 Fall)
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UNESCO - AVICENNA Virtual Campus, Online High Tech Entrepreneurship Course Project (2006)
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Emmungil, L. (2007) *Bilgisayar Donanımı* (Electronic Book)
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Emmungil, L., Akleylek, S. (2007) Improving the Security of Open Source Learning Content Management Systems. *International Scientific Conference on Information Technologies and Telecommunications in Education and Science*, Muğla
Emmungil, L. (2005) Türkiye'de İnternetin Eğitim Amaçlı Kullanımında İzlenmesi Gereken Stratejiler. *International Educational Technology Conference*, Sakarya
Emmungil, L., Yiğitcan, Ö., Erbaş, A. (2006) Constructed Web Site with the Collection and Organization of Existing Online Mathematics Education Materials to Support Mathematics Education for Instructors and Students. *International Workshop on Research in Secondary and Tertiary Mathematics Education*, Ankara

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