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Development of an internet-based exam system for mobile environments and evaluation of its usability

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The aim of this study is to develop an online exam system, which is easily accessible by students from computers and other mobile environments, and to carry out the usability tests of both mobile and web-based modules of the exams prepared by using this system. The system developed within the framework of this study provides the users with an electronic environment that can be used easily, quickly and effectively. The overall objective of the system is to meet the demands of students and teachers with regards to efficiency, practicality and effectiveness. Via this system, students can access exams by using their own mobile devices whenever and wherever they wish. Following the design and development phases, various usability tests were applied on real users regarding the effectiveness, efficiency of the system and user satisfaction. The data obtained revealed that the online exam system and the exams prepared by using the system were found to be effective, efficient and useful.

1. Introduction

Today, it is seen that many people that prepare for their exams are studying on buses, in parks or in a café with a test book in their hands. The tests prepared via electronic exam systems, now, have been an alternative for those who prepare for their exams by using their personal computers or other mobile devices. Connecting such services requires a computer and internet access. In other words, it is necessary that students must be in their homes or in a place which provides above mentioned conditions in order to access such electronic exam systems. In this study, the authors search for solutions to enable students to access these systems whenever and wherever they want rather than being have to be in a certain place.

Due to the practicality and the advantages of mobile devices and the solutions they have provided, the transition from traditional desktop systems to mobile devices has accelerated and the uses of these devices have become varied and more common (Oran, & Karadeniz,

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2007). One of the uses of mobile devices is "mobile learning", which can be defined as "all kinds of learning that do not take place in certain predetermined fixed places".

The aim of this study is to develop an electronic exam system that students who are preparing for their exams are able to access from their own personal computers or mobile devices, to evaluate the system developed and to determine its role and success with regards to educational objectives.

The system developed within the framework of the current study provides its users with a fast, effective and efficient electronic environment thanks to today's various mobile applications. In this environment, a platform has been developed to help students preparing for important exams study by using their mobile devices whenever and wherever they wish. The system aims at meeting the educational needs and expectations of both students and teachers in terms of effectiveness, practicality and efficiency. In order to evaluate the system in this respect, usability tests were applied to obtain data about effectiveness, efficiency and user satisfaction and the findings were analysed accordingly.

2. Mobile Learning and Online Exam Systems

Mobile-learning (M-learning) is a type of learning realized via mobile communication devices. Mobile learning is provided through mobile devices such as pocket PCs, PDAs (Personal Digital Assistant), and mobile phones as an alternative to traditional classroom environments. In other words, M-learning is an education model free from time and place (Kaya, 2002). According to Laroussi and Derycke (2004), M-learning also supports individual and cooperative learning in addition to its function to enable easy and fast access to the requested information anytime and anywhere. Moreover, it encourages students to develop feeling of responsibility, supports both individual and cooperative learning and makes monitoring and assessment of students during learning process easier. Keegan (2004) also claims that future education systems will be based on wireless environments and students will be using these systems via advanced mobile devices.

Georgiev *et al*. (2004) summarizes the relationship between distance learning and M-learning as follows: "Historically, distance learning has more than 100 years of experience and tradition. The most important feature of distance learning is to provide environments for students and teachers free from time and place. E-learning suggests new methods for distance learning based on computers and network-based technologies. In addition to e-learning, some different distance learning techniques such as "satellite-based distance learning" are still being used today. M-learning, one of these techniques, is a part of e-learning and an important component of distance learning as well."

The ideal time for individual learning is when learners need to access some sort of knowledge. When such need does not arise, it might be difficult to learn this knowledge. Thus, accessing information when the need arises results in longer and more effective retention (Riva, & Villani, 2005). M-learning provides equality in learning as well as faster learning and variety in the process. (Seppala, & Almaki, 2003).

Technically, it is possible to use mobile learning either online or offline. These two options have both advantages and disadvantages. Online education is advantageous in terms of speed, cost and more importantly being free from place (Bulun *et al.*, 2004). Moreover; there is no connection charge or cost since no service provider is used for communication in this option. Despite the following extra advantages such as always being up-to-date and the presence of

theoretically unlimited information and interactive education facilities, unfortunately certain amount of cost is charged for the users, which varies according to the size of the data downloaded or uploaded via the mobile devices used while receiving the services.

Kissinger (2013), in his study, evaluates the students' experiences with mobile e-reader devices during their learning process. The study is an important one since it reveals that social learning is realized considerably effectively via mobile devices.

Li *et al.* (2013) developed a Web portal using Amazon's "cloud computing service" and enabling the implementation of interactive learning processes and the preparation of interactive learning materials within the framework of mobile learning. This portal provides teachers with the opportunity to design online learning processes quickly without the prerequisite to have any kind of programming and technical knowledge. The applications and materials developed can be used in mobile devices having Android and IOS operating systems.

El-Seoud *et al.* (2013) carried out a study on a mobile application developed to learn and use sign language and contributed to the attempts to foster and advance the communication processes among hearing-impaired individuals and their interactions with regular people.

Cochrane (2012) suggests six success factors that are effective while realizing mobile Web 2.0 approaches. Accordingly, the author presents the analysis and evaluation of 35 different studies conducted between 2006 and 2011 while dealing with these factors. The studies examined consist of those dealing with the contribution of mobile Web 2.0 approach to higher education.

Mor and Mogilevsky (2012) conducted a study on whether students can be provided with an effective and efficient mobile education process via an application developed in "learning design studio" format. The application tested with the students of Haifa University was found to be a useful tool in mobile education process.

Rao, Sasidhar, and Kumar (2010) conducted a study on what extent mobile education approach that is realized via cloud computing approach facilitates learning process in terms of effectiveness and efficiency. They believe that this approach will take current learning approaches further by providing students with such an effective process.

Saran, Cagiltay, and Seferoglu (2008) developed a new system to teach foreign languages by making use of SMS (Short Message Service) and MMS (Multimedia Messaging Service) services. In the study, foreign language texts enriched with visual technologies were sent to the users' mobile phones via SMSs and MMSs in regular intervals. Since the application is supported by visual effects, the participants were observed to have learnt the pronunciation of the words more easily and more accurately.

In his study, Istanbullu (2008) designed a "Mobile Education Management System". The system, which is called as "Mobilim", provides online educational content for engineering faculty students and instructors via mobile phones. The evaluation of the system shows that "Mobilim" is a useful M-learning environment.

Tynan and Colbran (2006), in their study, evaluated the podcasts prepared for a total of six courses with the help of 1244 students attending Law Faculty University of New England. The evaluation made following the real application aimed at determining the effects of

podcasts in learning as well as the expectations and the experiences of the students with the podcasts. At the end of the implementation, it was found that the percentage of the students who were not familiar with podcasts prior to the application decreased from 46% to 3.5 % at the end of the semester, and the practice supplemented the education process with 65,3%.

In another practice, approximately hundred students attending Baptist Medical Center at Wake Forest University were distributed pocket PCs so that they were able to access reference information and the information about the patients whenever they need. Thus, this situation facilitated their learning, and both teachers and students were satisfied with the application to a great extent (Kho *et al.*, 2006).

Gulseren (2006), in the study titled "The Use of Mobile Communication Technologies in Student Information Management Systems and a Sample Application", developed a student information management system that involved static and dynamic information. By using this system, students attending a higher education institution would be able to access various pieces of information such as exam results and timetables via their mobile phones whenever and wherever they want.

Bastaki and Ajeeli (2004) developed a WAP-based registration system to prevent students from wasting their time during registration procedures, to reduce the workload of the staff and avoid the crowded queues. Thanks to this system, the students were able to fill out necessary forms by accessing these forms via mobile devices during registration dates wherever and whenever they want.

Mobile devices have the following advantages regarding their uses in M-learning: portability; use of handwriting; easy communication with other devices; unlimited access whenever and wherever needed; reasonable cost and popularity. However; small screen size, incompatible operation systems, and the problems with data security are the disadvantages of mobile devices (Wang *et al.,* 2003).

Various measurement and evaluation methods are used in order to assess students' success, to guide them effectively and to determine the weak points of the education they receive. Many researchers have emphasized that measurement and evaluation processes should be used appropriately and the objectives of these processes with regards to guidance and supplementation should be clearly understood in order to ensure effective teaching (Dwyer, 1998).

Online exams can be defined as a method in which the exam content is published on the internet and the exam results are automatically analysed and reported. It is very easy to form exams by using the questions entered into the system by the teachers according to certain criteria applied in online exam systems. The questions might be in various forms such as "multiple choice", "fill-in-the-blanks" etc. The difficulty levels and weight of the questions might also vary.

One of the traditional ways to prepare tests in distance education systems is "e-mail services" (Bull, & McKenna, 2003). In this method, the teacher sends test questions to the students via e-mail. The students receive these questions, answer them and send back to the teacher to learn his / her grade, which will also be sent via e-mail. The exam is evaluated by those who are responsible for this assessment. This process may last between one to five weeks. Since the number of students might be considerably high, providing feedback for each student might not be possible.

Automated exam systems are another method supported by today's technologies in which exam administration and assessment process are carried out automatically via a local area network or the internet. In such exams, the questions are restricted to multiple choice and matching type ones. It is necessary to train both teachers and students about the exam interface used in this method, so they will be familiar with the process in detail before the actual use (Torkul *et al.*, 2004).

Online exam systems can be used to test proficiency as well as to monitor students' learning process. Thus, the following issues should be taken into consideration in online exam systems:

- The questions in the system must be prepared to ensure easy comprehension. Exam system should be executable in common operation systems and web browsers.
- Questions should be presented and ordered in a way to avoid distractions on students' side.
- Online exam system should be user-friendly to ensure easy use even by the users with basic computer knowledge.
- The design of the database of online exam system should be simple enough not to slow down the overall system.
- The system should report the required data about the students taking the exams.

There are a lot of online exam systems with different structures and developed for various purposes. Among the most outstanding ones are as follows:

Meletiou (2012) introduces an online exam system developed in order to ensure the provision of fast and effective learning process for the users. Operating on the mobile phones with Android operation system, the system is a significant and effective application based on exam management and performance analysis on mobile devices.

The study conducted by Yu (2012) presents an online exam system developed by using J2EE technology for the exams administered in police departments. The test practices in this study showed that this application is successful in terms of efficiency and work load reduction due to its online features.

Gimeno-Sanz and de Siqueira (2012) carried out a study in which they dealt with an online exam system developed specifically for the foreign language exams administered as part of the university entrance exams in Spain. Called as "The PAULEX Universitas Project", the system was piloted in Valencia with more than 200 students.

Bodmann and Robinson (2006) examined the effects of paper-pencil exams and computer-based exams on the process and the points received from the exams. The subjects of the study consisted of 55 students who were familiar with computer-based exam interface use. Of these 55 students, 28 were administered the same test as computer-based exam and 27 in paper-pencil format. The exam consisted of 30 questions prepared from the content of the course "Educational Psychology" and had a multiple choice format with four options. The order of the questions was the same for each test and the duration of the tests was 35 minutes. In the study, ActıveInk web-based course content management system was used. No change was possible after the students submitted their answers. Although no significant difference was found between paper-pencil and computer-based test formats with regards to test grades, paper-pencil exam was found to last approximately 4 minutes longer than the computer-based one. In conclusion, it can be said that exam type does not have any effect on the grades

received, but it affects the duration of the exam.

Talu, Genc, and Kurum (2006) have developed an exam automation system in their study. Both students and teachers are able to access this web-based system, which only requires a Java-supported web browser and is free from any platforms. On the server side, there is a web server and relational database server. The communication with the database was realized via ODBC.

Wang *et al.* (2004) have developed a web-based assessment and test analysis system and later carried out an evaluation of the systems. The tool developed is made of trio-A model (Assembling, Administering, and Appraising). They named the software developed as WATA, which was programmed by using PHP and Pearl. The data retrieved is stored in MySQL database. The teachers access the system by using their own passwords. In WATA system, it is possible to add multimedia components to the question text such as photographs, animations and videos. The system also enables teachers to manage the exams and to do tool, item, test and misconception analyses. Finally, certain statistical calculations can also be made according to the results of the tests such as item difficulty, average test difficulty and item discrimination.

3. Methodology

3.1. Mobi – Exam Software

Mobi – Exam software used in this study was developed to ensure the access to exam system via the internet and the connection by using mobile devices. The technologies and platforms used while developing Mobi – Exam software system are as follows:

- As for the platform in web application, Visual Studio .Net Web and Smart Device were used.
- During programming phase, ASP dynamic query language was used for both the actions realized by the server and database application since it provides high performance and is a programming language with a simple syntax. AJAX scripting language was also used in this phase in addition to ASP.NET.
- The database used in the system was MySQL since it does not require any interface controllers, and is directly accessible through programming language, compatible, cost-efficient and highly secure. In order to access MySQL database from a local computer Navicat8.0 for MySQL program was used.
- Spiral software development model was used in Mobi-Exam software development process. This model consists of four phases; namely analysis, design, test and application. Development processes have been performed by starting from smaller sides of the system to the bigger and more advanced ones. The software was tested by the users during the development process.

3.2. Research Model

As for the research model of the study, scanning model was used in order to determine theoretical foundations. Scanning models are generally categorized under two main titles; namely general and sample case. Although this model might be used in some studies as the single model, any other research model used alone cannot be expressed. Scanning researchers might prefer to examine the object or the individual directly or they might refer to previously recorded information (printed document and statistics…etc.), historical remains and

knowledgeable individuals in the field. Later, they should interpret the obtained data by combining them with their observations into a system (Karasar, 2005). The quantitative methods were used to state and measure the data obtained from this study numerically. In this regard, the following approaches are followed:

- Online exam software to be used for Mobi – Exam system and prepared for the purposes of this study has been published on the internet.
- The software to ensure students' access to mobile exam system via mobile devices was installed into the mobile devices.
- A survey was developed to measure usability level and functional suitability in terms of visualising and interaction that are predetermined by examining the web-based product evaluation studies available in the related literature.

3.3. Subjects

The population of the study consists of students, teachers and administrators in various educational institutions in Turkey (especially schools and private courses). In this respect, the sampling of the study consists of 20 teachers-administrators and 120 students selected from the population.

3.4. Data Collection Tools

While developing the surveys for the purposes of this study, quantitative research method based on numerical analyses was considered. Thus, a need analysis survey form was used to determine the expectations regarding the use of online exam system via mobile devices. This survey was adapted from the need analysis used by Saran, Cagiltay, and Seferoglu (2008) in their study. Need analysis survey was administered to people from various schools and private courses in Turkey. The survey consists of 18 items and three parts; namely personal information, mobile phone use data and internet use data.

As for the usability test, which was administered after the need analysis survey, a task list was applied; 10 tasks for teacher participants, 7 for student participants and 7 for administrator participants.

Another survey used in the current study is "user satisfaction survey". Administered after the usability test, "user satisfaction survey" obtained data about the opinions and comments of the participants who were also given the usability test. Thus, a survey that consists of 10 items focusing on visualising and interaction of the website was administered in order to determine the satisfaction levels of student, teacher and administrator participants who used online exam system via web. In addition to this survey, another 8-item survey was administered to determine the satisfaction levels of 5 students who took the exam only via a mobile device.

3.4.1. Usability tests

A total of 20 participants (10 students, 5 teachers and 5 administrators) were chosen to administer the usability test of the software developed. Out of these 20 participants, 5 students, 5 teachers and 5 administrators accessed the online exam system via web, and the remaining 5 students via their mobile devices. Usability tests consist of certain predetermined tasks that users might see very often and use to complete significant actions in the interface. The users' behaviours while carrying out these tasks were also observed.

3.5. Data Analysis

The replies provided by the participants for the survey that is used as the data collection tool were first processed systematically into a data file and later evaluated accordingly. The evaluation process involved the percentages (%) and mean values ($\overline{X}$) of the obtained data.

4. Mobi – Exam Software System Structure

The software system developed for the purposes of the study is accessible via mobile devices such as laptops, smart phones and PDAs by using Wi-Fi connections. Figure 1 represents the system structure for Mobi – Exam.

Figure 1: Mobi – Exam system structure.

As shown in Figure 1, there are three types of users in Mobi – Exam system; namely, teachers, students and administrators.

The functions of each type of users are as follows: administrators are responsible for the system; teachers prepare questions and administer the exam; and students access and take the exam via web or mobile devices. Figure 2 presents uses cases diagram for Mobi – Exam system that displays the user types and the tasks they are responsible for.

4.1. The Modules Used by Students

The modules that might be used by the students in Mobi – Exam system can be explained in brief as follows:

4.1.1. Web module

Students can access the software system by entering the user names and passwords. If a student is not registered in the system, he can sign up by following some easy steps. Registration process is completed only when an administrator confirms the registration made by students. Otherwise student is not allowed to access the system.

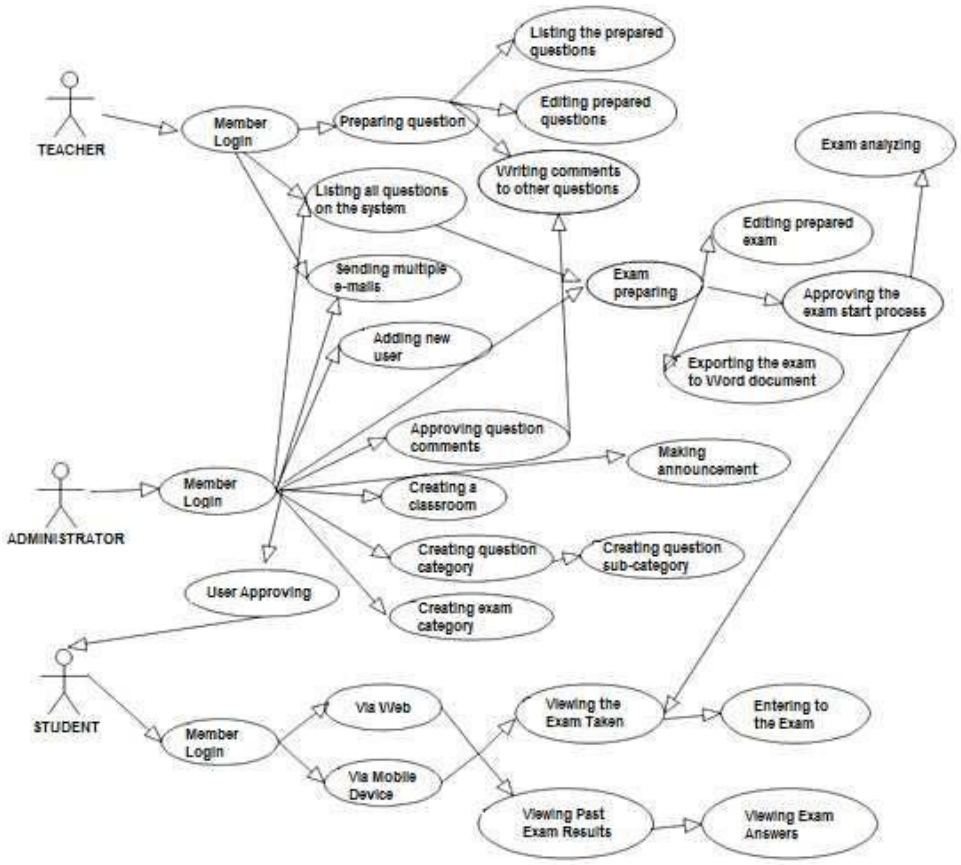

Figure 2: Uses cases diagram for Mobi – Exam.

When a student signs in the system by entering the necessary information, he can see the list of exams and specifically the ones he can take. These exams can be seen only when the exam is confirmed by the teacher. Later, the students can select the exam he wants to take and click on "Enter to the Exam" and access the page displaying the information about the exam. Detailed information about the exam is presented on "exam information page". At this point, clicking on "Start the Exam" button takes the student to the exam. Figure 3 shows a screenshot from the student exam view window.

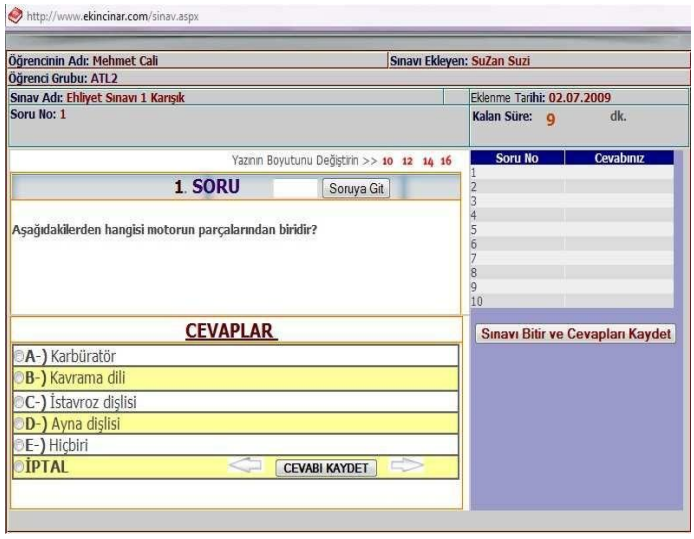

Figure 3: Student exam view window.

4.1.2. Mobile module

Mobile module uses two different software structures. In order access the system via mobile phones and mobile devices, wireless internet technology is used while the mobile devices with Windows Mobile operating system require additional software for the connection. These two software structures connect to the system via web services. These web services operate independently and can be developed easily on modern application platforms such as .Net and Java. In addition, they reduce the time spent and workload for the development of the software and have no weaknesses in terms of security.

In order to access the exam system via the mobile devices with Windows Mobile operating system, software developed specifically for this purpose should be installed into the devices first. The first step for the installation is to download the file "sinavpda.cab" into the mobile device. When this downloaded file is executed, the window which displays user name and password boxes pops up automatically. Figure 4 provides a view from the related window.

Figure 4: Access to the system from a mobile device (PDA).

When students enter the necessary information, the list of the exams that are uploaded beforehand is displayed on the screen. Students are able to access the results of previously taken exams as well by selecting the exam.

In order to access a specific exam, students can select the exam, and click on the related button for starting the exam. The questions for each exam are asked one by one. It is possible to display the questions in a certain order or students can answer the question they want by writing the question number. Figure 5 represents a view from the exam interface (in a mobile device).

Figure 5: Exam view window in a mobile device (PDA).

It is necessary to use a mobile phone with wireless internet connection function if students want to access the system via their mobile phones. By using a web browser available on the mobile phone, students can access to the website. Although accessing the system and exam procedures are similar, typical exam procedure may differ according to different web browsers provided on different mobile phones.

In mobile module, duration of the exam is not displayed in order to reduce test anxiety, to prepare students for real exams and enable them to prepare for the exam free from place and time restrictions.

5. Findings and Discussions

5.1. The Findings Obtained from the Usability Tests

A total of 10 participants were administered usability tests. Of these participants, 5 students used the system via web and other five students via a mobile device. The system-based time differences during the administration of the test were ignored. Before usability test is applied, the users were given a "participant information form" to fill out.

5.1.1. The findings obtained from the participant information form

The information form prepared for students consists of 11 items, which involve personal information and mobile device use information. Table 1 presents the findings obtained from this form.

Table 1: Student participants' characteristics.

	Web Software Participants					**Mobile Software Participants**				
	K	L	M	N	O	P	R	S	T	U
Age	19	17	18	17	18	17	19	17	16	18
Sex	M	M	M	M	M	M	M	M	F	M
Educational Background	High School	High School	High School	High School	High School	High School	High School	High School	High School	High School
Have you got your own computer?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Do you use the Internet actively?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have you ever used an online exam system on the Internet?	No	No	Yes	No	No	No	No	No	No	No
Have you got your own mobile phone or Pocket PC?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have you ever accessed the Internet from your mobile phone?	Yes	No	Yes	No	No	No	No	Yes	No	Yes
Have you ever installed any programs on your mobile phone?	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Have you got any programs with educational purposes on your mobile phone?	No	No	Yes	No	No	No	Yes	No	No	No
Have you ever accessed a Mobile-education system with your mobile phone?	No	No	No	No	No	No	No	No	No	No

As Table 1 shows, there are two different student participant groups; namely web software users and mobile software users. Web software users are symbolized as K, L, M, N and O respectively and mobile software users as P, R, S, T and U. Of these ten participants, nine students are males and 1 female. The ages of the participants range between 16 and 19. All the student participants are high school students preparing for university entrance exams by attending private courses and their own schools. All of the participants own personal computers, and are active users of the internet but do not have any information about online exam system. Similarly, all the participants have their own mobile devices. Of these participants, K, M, S, U accessed the internet with their own mobile devices. K, M, N, R, S and U stated that they knew how to install a program to their mobile device, however only M and R student participants told that they installed some programs for educational purposes. It can be concluded that not all student participants have information about mobile education.

5.1.2. Usability of Mobi – Exam system web software

While deciding on the tasks, the basic function and objective of the web software were considered. The equipment and tools needed in the environment where the usability test is applied were prepared and necessary explanations were made to the users before the application. The selection of the participants was based on voluntariness. The participants were told that they can skip the parts they find difficult and even finish the test when they feel bored. There was not any interaction with the participants during the administration of the test. When the time allocated to finish the test expired, some short explanations were made to the participants.

5.1.3. Usability of M-Web exam system mobile software

Five students who took this test were asked to complete seven tasks. The participants P, R and S completed the tasks via their mobile phone while the participants T and U used the software developed for mobile devices. The time spent to complete the tasks was given in "seconds". The time units given with an asterisk next to them means the participant couldn't complete the task so the maximum time allocated for the tasks (300 seconds= 5 minutes) were written in the chart for that particular task. Table 2 shows the analysis of the performed tasks.

Table 2: Student participants task analysis for mobile device software.

Tasks	**The Time Spent (in seconds)**					
	P	**R**	**S**	**T**	**U**	**Mean**
Registering to M-Web exam site	300	220	238	210	192	**232**
Logging on to M-Web exam site	15	18	19	19	16	**17,4**
Accessing to the exam prepared by the teacher.	20	19	22	20	21	**20,4**
Accessing to the first two questions and saving the answers.	46	49	38	31	33	**39,4**
Proceeding to fifth exam question directly	38	41	41	28	19	**33,4**
Saving the exam	15	21	36	14	11	**19,4**
Checking the correct and wrong answers and unanswered questions.	25	46	38	300	72	**96,2**

Since the participants had to enter a lot of information during the registration phase, the time spent for that task was relatively longer than the others. The average time the participants spent to access the exam prepared by the teacher is 20.4 seconds. It was found that the participants did not find it difficult to enter the system. The reason for this situation might be that there is not any unnecessary-extra information on the home page. Similarly, the participants easily used "previous question" and "next question" buttons while proceeding to other questions. In the task "directly proceed to the fifth question", the entire participants used "next question" button one after the other until they reached the fifth question. As shown in Figure 6, all the students successfully completed the following tasks; accessing the exam, displaying the exam questions, proceeding to next questions and saving the answers they provided in the exam. The average time spent "to save the exam" tasks is 19.4 sec. The average time spent for all the tasks was the highest with the participant T.

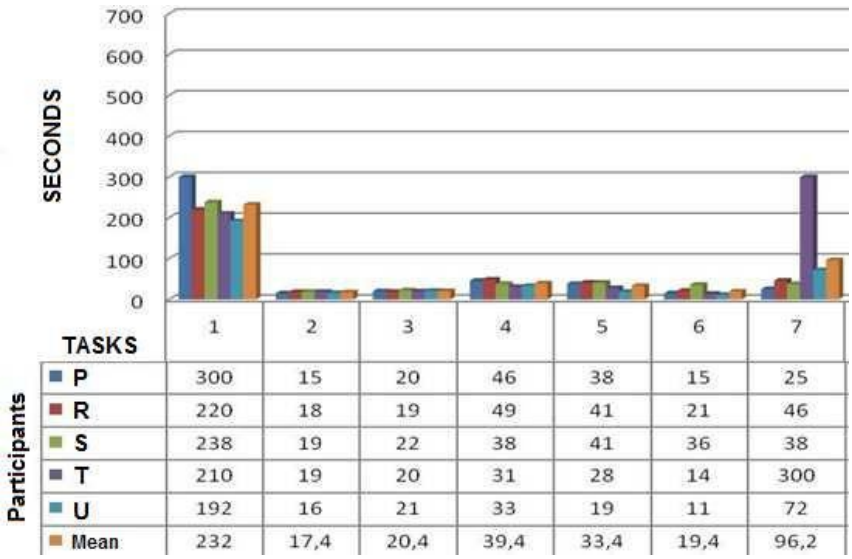

Figure 6: Comparison of task completion times of student participants for mobile device software.

The general findings obtained from the observation of the whole process performed by student participants (using Mobi – Exam system via a mobile device) are as follows:

- While connecting via mobile phone (wireless internet), the participants had to wait for sometimes due to the problems caused by service provider company.
- Mobile devices were used by students very easily.
- Student participants were able to access to the exams easily.
- Student participants answered the questions in the given order.
- Sometimes it was difficult to read the questions on the screen since some mobile phone do not have graphic display function.
- It was relatively more difficult to access the information regarding correct, wrong answers and unanswered questions in mobile software than web software.

Results – feedbacks regarding to the software satisfaction survey are also provided under Table 3.

Table 3: The results of mobile software satisfaction survey.

Statements	Very Bad		Bad		Not Sure		Good		Very Good		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
1- I can easily access to the exams from a mobile device.	0	0	0	0	1	20	3	60	1	20	5	100
2- Generally I can easily access to the software system.	0	0	0	0	0	0	5	100	0	0	5	100
3- I can access the results of the exams I take	0	0	0	0	2	40	1	20	2	40	5	100
4- I can easily read the exam questions on the screen.	0	0	0	0	1	20	3	60	1	20	5	100
5- I can access the exam	0	0	0	0	0	0	2	40	3	60	5	100

questions quickly.												
6- I can easily proceed to the exam questions I want	0	0	0	0	0	0	3	60	2	40	5	100
7- Anyone with a certain level of computer literacy can easily use this service.	0	0	0	0	1	20	4	80	0	0	5	100
8- Generally I find it easy to use the software.	0	0	0	0	0	0	4	80	1	20	5	100

Because of the high percentage (88%) of positive opinions (good and very good) in all the items in the surveys, we can conclude that students can easily take the exams via mobile devices. The high successful completion rate of the tasks shown in Table 5.3 and high percentage (80%) positive opinions stated regarding the use of software in general support this conclusion to a great extent.

However; it was observed that student participants couldn't access the exam result very easily, which is supported by the fact that 40 % of the participants replied "not sure" to the item "I can easily access the results of the exam I take". The participants stated that accessing the exam questions and proceeding to other questions were very easy. 20 % of the participants replied "not sure" to the item "I can easily read the exam questions on the screen". Since some mobile phones do not have graphic display function, it is normal that some participants had problems reading the exam questions.

6. Conclusions, Recommendations, and Future Work

In order to ensure the provision of equal opportunities in education, each individual must have his / her styles and methods of learning suitable for his needs and interests. Generally; it is true that many students suffer from test anxiety and study for their exams in different places whenever they find time to do so. In this study, the authors developed a system that allows students to study for their exams comfortably anytime and anywhere they want by using their mobile devices. In addition, it is known that preparing multiple choice questions take longer time than other question types. Therefore, forming a question bank among teachers was also one of the objectives of this system – study. One of the functions of the system which is favoured by the users is to enable teachers to write their comments and critiques about the questions prepared by other teachers (in-site interaction).

The results of the study also show that the system has been found interesting by teachers and students. One of the reasons of this conclusion is the increasingly intensive use of mobile devices in today's world. According to the data obtained from the surveys, there is an increasing interest in mobile devices and these devices are primarily used for other purposes rather than education, and finally people were not aware of this function of mobile devices. Developing new systems that might encourage students to use mobile education is quite significant because learning with the highest retention is possible only when people access information whenever the need arises.

On the current form of the system, and according to the results obtained with the performed work so far; it is also possible to express some recommendations that have been thought by the authors. In the future, these recommendations may also cause performing newer research works on the related system:

- First of all, it might be an interesting aspect to focus more on visual design of the system and perform more detailed works if users think about any necessary revisions on current visual forms of the system.
- It might be an important and interesting scientific research approach to enable students from different countries to see if using experiences may differ in different countries and different feedbacks may come from the related students.
- It also might be an interesting approach to employ the system in different kinds of courses (social science or natural science based, highly theoretical or highly applied…etc.) to evaluate its effectiveness on different course types and structures.
- Another remarkable approach to obtain some scientific findings might also be enabling different educational institutions, where students are educated for specific exams, to use the system along their educational processes, and evaluate if the usage of system may make it more effective to educate students and improve students' success levels at the end.

In addition to the expressed suggestions, which are known as some potential future works among the authors; there are also some additional, planned future works to improve the current form of the mobile system. These future works include improving the whole system using experience by providing more options while preparing questions – exams, and using some intelligent (artificial intelligence based) techniques to form more accurate exams, or obtain automatic evaluation results after taking any exam.

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