

## DISCOVERING HOW STUDENTS SEARCH A UNIVERSITY WEB SITE: A COMPARATIVE USABILITY CASE STUDY FOR PC AND MOBILE DEVICES

**Assist. Prof. Dr. Erhan Şengel**

*Uludağ University, Faculty of Education  
erhansengel@uludag.edu.tr*

### ABSTRACT

This study aims to investigate the usability level of web site of a university by observing 10 participants who are required to complete 11 tasks, which have been defined by the researchers before to gather data about effectiveness, efficiency and satisfaction. System Usability Scale was used to collect data about satisfaction. The research result, completed by the 10 participations show that the tasks' average completion time is 1614,6 seconds and average success score is 93.36. In addition, most of the participants indicated that it was difficult to use the web site when mobile device is used. All the participants show a positive attitude and belief that this site helps the users about finding information about university.

**KEYWORDS:** Human Computer Interaction, Usability, Mobile usability, Effectiveness, Efficiency, and Satisfaction.

### INTRODUCTION

In the last decade, interactive technologies, especially Internet technologies and mobile devices, are evolving quickly. These rapid growths force us to use them in our daily lives intensely. The population in the World increases every day and the hardware being used in these technologies is getting cheaper. Meanwhile, the size and methods of using these technologies are changing quickly.

The popularities of using mobile devices also increase. Portio Research (2012) predicts that mobile subscribers worldwide will reach 7 billion by the end of 2013 and 8 billion by the end of 2016. Deloitte (2012) announced the results of a research study called "State of the global Mobile Consumer: Connectivity is core". According to result of the study in which data are collected from an online survey applied in 15-country, the proportion of mobile devices that are connected to Internet increases sharply. Although the proportion of smartphones that are Internet-connected is approximately 78 % in developed countries, this proportion in Turkey as a developing country is 91 %. At the same time, The Deloitte Global Mobile Consumer Survey reported that 15 % of the populations in developed countries and 19 % of the developing countries have access to a tablet. The ownership or access to tablets in Turkey is 13 % (Deloitte, 2012). Information & Communication Technologies Authority (ICTA) (2012) announced that the number of Internet subscriptions from tablet is about 2 million with 42% annual growth rate and the number of Internet subscriptions from mobile Handset is about 10 million with 142% annual growth rate in Turkey. Moreover, International Telecommunication Union (ITU) (2011) denotes the latest global ICT facts and trends on Internet use. In this report it is indicated that 45% of Internet users are below the age of 25. 30% of the Internet users are below 25 in developing countries.

The number of student in high schools is approximately 5 million and number of students in higher educational institutions is about 4 million. The number of teaching staff in universities is about 70 thousands and approximately 200 thousands public employees in universities (TSI, 2012). Today, web pages have become an important part of life for people from different regions of the world to share knowledge. Public and special institutions provide some of their services through web pages. Variety of persons, including current studying and graduated students, academics, workers benefit from these services. Therefore the importance of usability in design of universities web page is certain.

The numbers of user use Internet technologies increase. However, the types of people are different. Some users get used to some of the complicated computer related applications because of education level, computer knowledge or just because of interests. However some of them do not have enough knowledge or experience in using computer-mobile devices or using these applications. Even advanced users confuse in using some products that are used with computer. So, the technologies working with computer should be designed in such a way that they will not force users to understand when first interact with it (Şengel, 2013). To have users to access to the technology in an effective and efficient manner, and to be satisfied with them, the usability issue has become an important issue. So that with consideration of the properties of people and machines to be designed in the event more "usable" products could be developed that focus on human-computer interaction is also important (Özdemir, Atasoy & Somyürek, 2007). Human computer interaction is an interdisciplinary study of the design

and use of interactive technologies, which aims to support the development of more usable and humanly acceptable systems.

Various definitions of Human Computer Interaction (HCI) are given. Dix, Finlay, Abowd & Beale (1998) stated that “HCI is the study of people, computer technology and the ways these influence each other” (p. 8). Hewett et al. (2009) stated that; “HCI is defined as a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.” “HCI is emerging as a specialty concern within several disciplines, each with different emphases: computer, psychology, sociology and anthropology, and industrial design “(Hewett, et al. 2009).

### **Usability**

Various definitions of usability have been made. Nielsen (1994) defined usability as “ease of use, learnability, efficiency, recall group, decrease in the number of errors, recovery and user satisfaction.” In addition to that Nielsen (2005) described the usability studies as within the context of specific cases of people using technology to uncover their behavior. International Standardization Organization (ISO) is associated usability with the effectiveness, efficiency and satisfaction criteria. Effectiveness, the use of a system is determined by the degree of reaching the goal. Efficiency is a measure of resources, which must be spent to achieve these goals. Satisfaction is the degree of the user's system in finding an acceptable (Bevan, 1995).

A usability test is intended to determine the extent an interface facilitates a user's ability to complete routine tasks. Typically the test is conducted with a group of potential users either in a usability lab, remotely (using e-meeting software and telephone connection), or on-site with portable equipment. Users are asked to complete a series of routine tasks. Sessions are recorded and analyzed to identify potential areas for improvement to the web site.

Today, web pages have become an important part of life for people from different regions of the world to share knowledge. Therefore the importance of usability in design of any web page is certain. When the review of literature is investigated, there is a huge amount of research about usability. But, there is no usability evaluation research in the context of a mobile environment. The present work is a pilot study providing preliminary findings for an impending study aiming to compare the usability of the website of a randomly selected university by using computer and mobile devices. The preliminary study is trying to establish usability testing for university web pages and develop guidelines for university web page designers. In this research, it is tried to find out whether the structure of web site is easy to find any information or not, and find out whether the users are satisfied or not while using the site with different devices. Therefore, this research aims to fill this gap and in doing so will also provide a roadmap for future of relatively new research area, mobile usability studies. The problems of this study are to find out time spent to reach desired page, number of errors made till finding page and the satisfaction rate of users in using web site.

### **METHOD**

Methods of usability testing can be categorized into model/metrics based, inquiry, inspection and testing. In usability inquiry techniques, usability evaluators obtain information about users' experiences with system by interviewing them, observing them while using the system, or having them respond to questions in questionnaires (Zaphiris & Kurniawan, 2007). In a project, web pages of universities in Turkey were searched to develop guidelines for design. In Turkey, there are 109 state universities and 69 private universities. To achieve the desired outcomes, universities were randomly selected to make a usability testing. After selection, an expert evaluation of the chosen web site against established usability guidelines had been carried out before the empirical evaluation and representativeness of the chosen web site was requested. In this study, users were observed while they use the Website of Sakarya University by using PC and smartphone. There are not any differences between the design of the PC/laptop and mobile versions. The present study is not a study conducted to solve the usability problem of a particular website.

### **Procedure and Instruments**

In this research, to measure the learnability, effectiveness and efficiency of the site observation method was used for usability testing. At the beginning of the session, the test administrator explained the test session asked them to use think-loud protocol as they use the site. All the sessions are recorded and analyzed by using Morae 3.2., usability software that offers an all-encompassing testing experience for its users. It records user interactions, efficiently analyzes results, and instantly shares your findings (TechSmith, 2012). Morae contains three different sub-programs namely, Recorder, Manager and Observer. After initial details, task scenarios and settings are calibrated, Morae Recorder captures audio, video (either web cam on the computer or a separate camera), on-screen activity, and keyboard/mouse input during a research session. After records are completed, Morae

Manager is used to view and analyze recordings, automatically calculate metrics, generate graphs, and create highlight videos. With Manager, tasks and markers and all data are marked on time line. Data for usability metrics (effectiveness, efficiency and satisfaction) can be calculated and graphed easily. All results can be transferred to PowerPoint slides to present and share with others. In addition, Morae Observer enables team members to watch the customer's experience, make notes, flag tasks, and chat in real-time by using another computer connected to user's computer. But, in this project, Observer was not used.

By using Recorder, a questioner was applied to collect demographic information about audience and experiences in using Internet. Each of the participants joined to test at different times, alone. Then reviews of participants about the web site were asked. While participants performing 11 tasks given to them, researchers need to collect the data they have made some observations. Tasks were generated from a study, done by Şengel and Öncü (2010), investigated how the university's website has been being used by the students.

Participants read the task scenarios and tried to find the information on the website. During the test, the researchers did not help to the participants to complete the given tasks. Participants end each task session himself if he thinks that he had found what is required. Researcher did not mention whether his claim about finding right page is true or not. Immediately after the experimental procedure for each task a questioner with three questions were asked to confirm whether the participant was lost in the site and whether he found the required page by chance or not.

Satisfaction of individuals' data were collected by using System Usability Scale (SUS) (Bevan, 1995) with choices measured on a 5 point Likert scale (strongly agree (5), slightly agree (4), undecided (3), slightly disagree (2), strongly disagree, (1). SUS includes 10 questions with positive and negative statements. Results of SUS score are between 0 and 100.

After recording sessions, Time spent in completing these tasks and the numbers of errors made were analyzed by using Morea Manager Program. During analyze, markers to inform errors, non-critic errors, observations, comments are inserted on time line with different colors.

The same procedure is applied to participant using mobile devices. In both devices, same types of browsers were used and all devices were connected by Wi-Fi to the Internet to have an equal download rate. There are not any differences between the design of the PC/laptop and mobile versions of the web sites. The difference between using computer and mobile device is that pre-survey, questions asked after completing each tasks and SUS were administered by paper and pencil. Video records were imported to Morae Manager and analyzed in the same manner as in using computer.

**Sample of the Study**

Nielsen (1993) stated that 10 participants are sufficient for usability testing. It was also stated that 75% of usability problems could be detected with 5 participants. Figure-1 shows the relationship between the number of problems detected and the number of participants used in usability testing (Çağiltay, 2006). In this study, 5 participants used laptop and 5 participants used mobile device in usability testing.

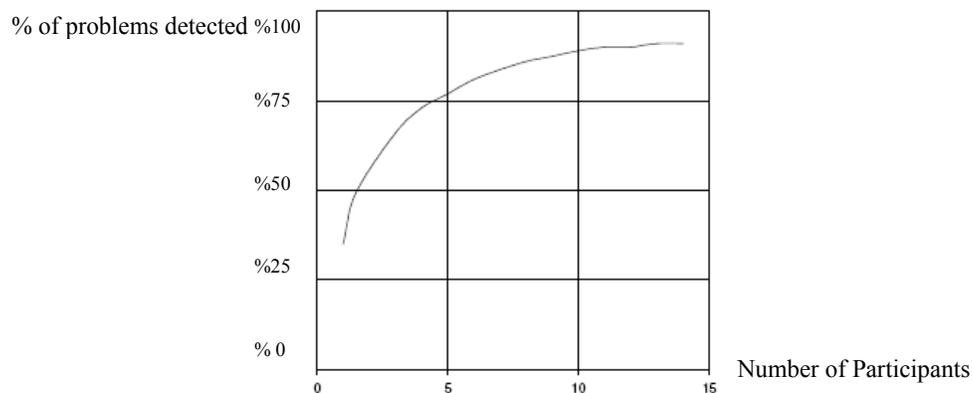


Figure 1: Problems detected vs. Number of participants

The target audience of research consists of people who can use the Internet and are between 18 - 25 years old. % 80 of the participants was studying at a university, two participant were 25 and none of them have ever joined in

usability test applications before. They have own a PC and smartphone and have been using PC and smartphone at least more than 1 year. They do not have any physical disability. Moreover, they had not used or seen the website being studied. The distribution about the amount of time using Internet and daily time spent in Internet are shown in Table-1. Each individual session lasted approximately one hour.

Table 1: How long participants use computer & internet

How many hours do participant use computer weekly?		How many hours do participant use internet daily?	
Hours	# of participant	Time	# of participant
0 – 10 hours	2	Less than 1 hour	1
11 – 25 hours	3	1-3 hours	3
More than 26	5	4-6 hours	4
		7-10 hours	2
Total	10	Total	10

## FINDINGS AND RESULTS

### Findings for effectiveness and efficiency

Descriptive statistics relating to the research findings and statistics are based on the comments below.

In order to answer the first aim of the research which is to find the time spent for each task and the number of errors done while the participant tries to complete the desired task. For this purpose, the average time spent for each task is recorded as shown in Table-3.

Table 3. Average Time Spent & Success Rates for Each Task for PC and Smart Phone Users

Tasks	PC		Smartphone	
	Average Time Spent (s)	Success Rates (%)	Average Time Spent (s)	Success Rates (%)
Task 1	56,10	100	49,50	100
Task 2	<b>96,3</b>	<b>25</b>	<b>127,35</b>	<b>75</b>
Task 3	<i>126,15 *</i>	87,5	<i>163,80 *</i>	87,5
Task 4	34,05	100	66,45	100
Task 5	<b><i>147,30 *</i></b>	<b>75</b>	<b><i>244,65 *</i></b>	<b>25</b>
Task 6	<i>120,60 *</i>	<i>100</i>	<i>124,05 *</i>	100
Task 7	<i>141,75 *</i>	80	<i>129,45 *</i>	100
Task 8	53,25	100	75,90	100
Task 9	<b><i>137,85</i></b>	<b>25</b>	<b><i>279,00 *</i></b>	<b>25</b>
Task 10	<b>83,40</b>	<b>0</b>	<b><i>225,75 *</i></b>	<b>0</b>
Task 11	<b><i>101,70</i></b>	<b>75</b>	<b><i>291,00 *</i></b>	<b>100</b>
Average	99,86		161,54	

(\*: time spent more than average, italic and bold faced: distinct in means for mediums)

The chart below displays a summary of the test data. The average time spent for each task for each participant for each group, PC and Smartphone is shown in Figure-2.

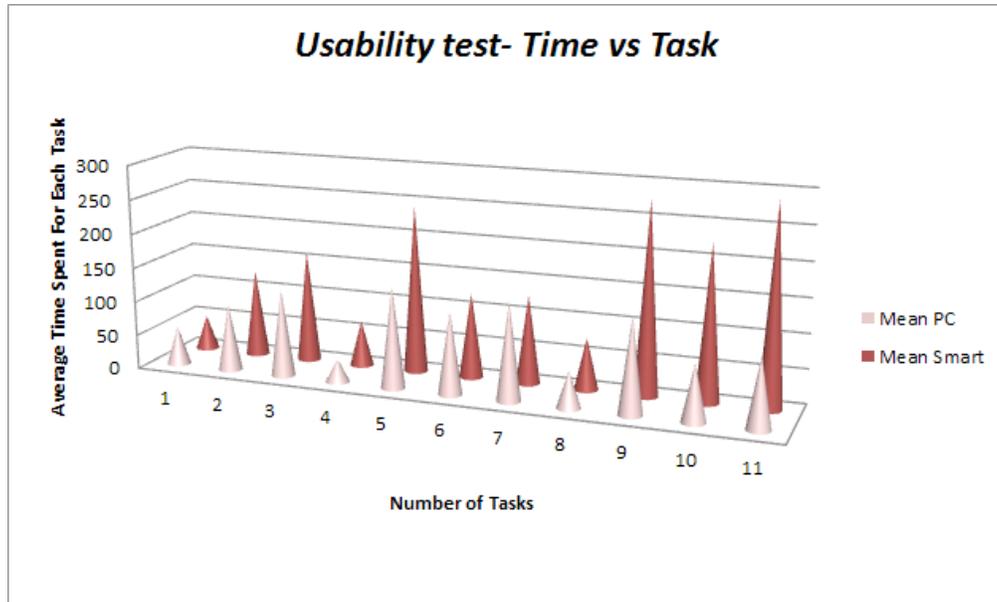


Figure 2: Usability test- Time vs Task for each medium

Average time spent for all sessions is approximately 1614,60 seconds (27 min). However, average time spent just for doing tasks took 1437, 68 seconds (24 min). During the sessions, time spent just for completing tasks are 1098,45 seconds for participants who used PC and 1776,90 seconds for participants who used smartphone. Long time to complete tasks shows that the efficiency of the web site was low. For PC users, the time required to complete tasks numbered **1, 2, 4, 8** and **10** took less than average. However, for tasks **3, 5, 6, 7, 9** and **11** it was difficult to accomplish the task. Meanwhile, for smartphone users, the time required to achieve desired tasks numbered **1, 2, 4, 6, 7** and **8** took less than average. However, for tasks **5, 9, 10** and **11**, it was difficult to complete the task (Table 3). As shown in table 3, although users in both cases behaved in the same manner for tasks 1, 2, 4, 5, 8, 9 and 11, the time spent for these tasks in smartphone are more than these in PC users. The big difference between the times spent in different devices might be because of the screen size of the smartphones. Not designing the web site compatible for mobile devices might be another reason for this distinction.

The chart (Figure 3) below shows the average number of error done for each task while participants try to accomplish given task successfully. When the error rates for tasks for different devices were compared, the average number of errors was almost the same for some tasks like task numbered with 2, 3 and 8. But, there were differences in other eight tasks in such a way that the average numbers of errors done in using smartphone were almost twice as the number of errors done in using PC.

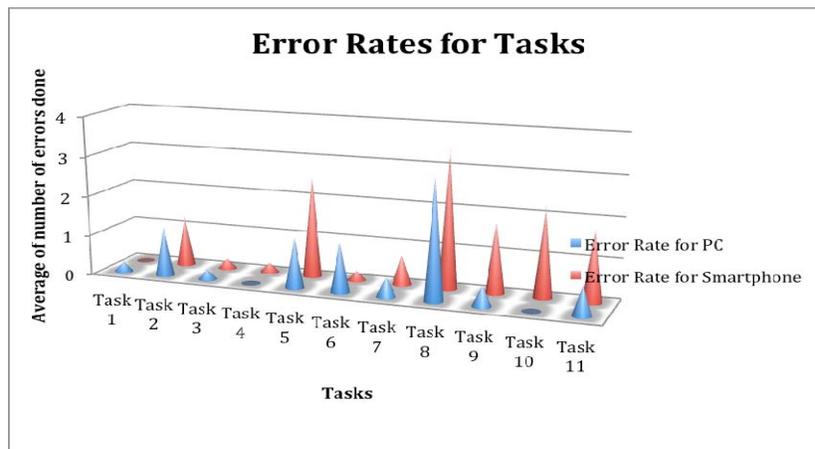


Figure 3: Error Rates for Tasks for different devices

When the time spent for each task in Figure 2 and the average error done for each task in Figure 3 are compared, there was a positive relation between them. As well as spent time for tasks numbered 5, 9 and 11 were longer,

the error rates for the same tasks were also more compared to others. However, the total number of errors was low considering that the participants used this web site for the first time. Because of environmental and psychological factors, users might make some mistakes and errors when they use any system first time, even users are experienced in using the system or even the system or web site is well designed (Özdemir, Atasoy & Somyürek, 2007).

To complete the task-1, participants using PC and smartphone spent an average 56,10 seconds and 49, 50 seconds respectively in order to find student registration. In addition, the success rates were 100 % and 100% respectively. In this task, the average number of errors done to achieve desired page were 0,25 for PC users and 0,00 for smartphone users. It was easiest task for participants to accomplish, because most of them were university students. They get used to registration system. Moreover, the link for system could be found easily. All participants stated that they had estimate where they could find the related information in the site.

For task 2, participants had to find daily or monthly meal list if they would like to have lunch in university cafeteria. The participants in PC group and smartphone had spent average 96,3 seconds and 127,35 seconds (lower than average) respectively and gained 25% and 75% success rates respectively. 25% of the participants could not complete the task. 37,5% of them completed with difficulty and the rest completed in longer time than average. Three of them forced to terminate in finding the meal list because the position of the list's link is placed in the navigation. In navigation menu, there were two menus called as "Life in Campus" and "Links". Users expected to find it in "Life in Campus" and could not find there. But it was placed in "Links" menu and called as "Web Menu – Monthly Food Menu System". Name of the link did not mean anything to some participants. Because of this, the number of errors participants made while trying to complete the task scenarios was high in both users group with an average of 1,25.

To complete the task-3, participants using PC and smartphone spent an average 126,15 seconds and 163,80 seconds respectively in order to find academic calendar. In addition, the success rates were 87,5 % for both PC and smartphone users with 4 errors' in total. One participant could not have completed this task. 3 of them completed with ease, but 4 of them completed with difficult. Main reason for this error was that although link for academic calendar was placed in an appropriate menu, users were directed to another web site called as "Directorate of Student Affairs", and then they searched for the task in the new site opened in new tab. Because of that, participants stated that they lost their position in the site.

The aim of task 4 was to find calendar of events, which could be completed in a single step. The task was accomplished with 100% success rate in both groups. Average of 34,05 seconds in PC application and 66,45 seconds in smartphone application were spent to complete this task. In general, this task seems too easy for participants.

To complete the task-5, participants gained an average 50% success rate by spending an average 147,30 seconds in PC users and 244,65 seconds in smartphone users. In both case times spent to achieve desired outcome were higher than the average values as shown in Table 3. Although achieving the conditions to apply Erasmus program can be done in two steps, two participants in both groups (total five participants) were not able to complete this task. One participant from PC users completed the task with difficulty. Moreover, 3 participants (one from PC users and two from smartphone users) forced too much to accomplish the given task. It was the one of the most difficult duty. After all participants found related link in the web site, the web browser directed to a new web site in a new tab as in task 3. In the new site, there was a menu bar at the top with 9 selections. There was a big picture in the middle. But, such a big picture camouflage local navigation. However, this big picture made user to scroll down. The required information cannot be found in the menu bar. It is placed in local navigation. Because of this, the number of errors participants made while trying to complete the task scenarios was high. In this task, the average number of errors done by PC users was 1,25 and that was 2,5 for smartphone users. The big difference between error rates was because of screen size and the picture and scrolling effect used in the site.

To complete the task-6, participants using PC and smartphone spent an average 120,60 seconds (higher than 99,86, the average) and 124,05 seconds (lower than 161,54 the average) respectively in order to find contact information of Dean of the Faculty of Education. In addition, the success rates were 100% and 100% respectively. In this task, the average number of errors done to achieve desired page were 1,25 for PC users and 0,25 for smartphone users. All of the participants completed this task with a total of 8 errors. 25% of the participants completed with ease and 75% of them forced too much to complete. Most of the participant thought that menu names as "Contact" will give information about detail contact information for all of the faculties and departments in the university. But "Contact" menu gives only contact information about university. To

minimize this problem, web pages of sub-divisions of the university should be designed by using the same template.

When the participants were asked to eligibility conditions to use library to accomplish 7<sup>th</sup> task, except one of the participant, three of the participant in PC group completed the task with difficulty and one could not complete the given task. Participants in this group spent 141,75 seconds with 80% success rate. The average number of errors done by PC users was 0,5. However, in smartphone group, three of the participant completed the task easily. But, one of them completed the desired task with difficulty. 129,45 seconds was spent by participants using smartphone with 100% success rate. The average number of errors done by smartphone users was slightly higher than done by PC users with a value of 0,75. Although the 7<sup>th</sup> task could be completed in two steps, participants had difficulty in finding the required link because of font size used in library web site. Again, because of screen size of smartphones, participant had difficulty in achieving the result efficiently and effectively. Participants in both group stated that another reason for low efficiency (spending more time) was the background color of the web site of the library of the university.

In task 8, participants needed to find brief description, opportunities and publicity of the university. Participants gained 100% success rate by spending an average of 53,25 seconds as PC was used and 75,90 seconds as smartphone was used in the study. There was a navigation called as “Our University” in general menu bar. Because of this, it was easy to complete this task.

Universities are, of course, for students. But, academicians also visit web sites of universities as well. Therefore, needs of academicians have to be fulfilled. To test whether the web site supports this aim or not, participants were asked to find out application form for Scientific Research Project department for task 9. It was the task that took the longest time to achieve. Only 20% of participants could complete the task. One participant from each group (PC and smartphone) found the application form after slogging for a long time. Rest of the participants stated that they could not go any further after spending average time. Participants using PC and smartphone spent an average 137,85 seconds and 279,00 seconds respectively in order to achieve the task. In fact, all participants found the link to go to web site of Scientific Research Project department. But, they could not find the required information on that site. The navigation bar is different for some menus. The task 9 can be completed in 6 steps. This results support Porter conclusion stating that users might leave the site unless they can find what they are looking for within three clicks (2003).

In our country, most of the universities have Faculty of Medici and these include Hospital in their structure. Hence, web site of universities might also serve to the public. Because of this reason, participants were asked to expose the phone number to make appointment to any polyclinic. But, none of the participant achieves to find out the number. This was the only task that no body completed. The reason for this is that the web site of the Faculty of Medicine does not include any information about appointment. As in the task 9, the participant left the site after consuming time. Since these pages are also used for public, the communication and contact information should be added.

To complete the task-11, participants using PC and smartphone spent an average 101,70 seconds and 291,00 seconds respectively in order to find tender news. In addition, the success rates were 75 % and 100% respectively. In this task, the average number of errors done to achieve desired page were 0,75 for PC users and 1,25 for smartphone users.

### **Findings for satisfaction**

Satisfaction of individuals' data were collected by using System Usability Scale (SUS) (Bevan, 1995) with choices measured on a 5 point Liker scale (strongly agree, slightly agree, undecided, slightly disagree, strongly disagree). SUS includes 10 questions with positive and negative statements. Bevan (1995) stated that, if the average value taken from SUS score is between 65-70, it could be stated that participants satisfied with the page design. In this study, it was found that, the average SUS score for PC users was 43,75 and the average SUS score for smartphone users was 54,38. In both cases, the participants were not satisfied with the web site. They indicated that there were too many inconsistencies in the web. But, at the same time, they think that various functions in the web were well integrated.

### **CONCLUSIONS**

The objective of the present study is: to compare the usability of the website of the Sakarya University. In this study, when the time spent for each desired task is investigated, it can be realized that the respond time of web site is fast. As indicated in resent study, the respond time of a site affects the usability of this site by users (Polkosky and Lewis, 2002; Krug, 2007).

The highest average time spent and the highest numbers of error done throughout this study are 244,65 seconds and 20 errors respectively for task-5. Participants' had difficulty in gaining access to conditions to Erasmus program, which form the lower section of the guidance corner. This means that using scrolls for a web page decreases the usability of that page. To increase the usability of a site, it is required not to use scrolls, mainly in home pages.

40 % of the participants were not able to complete task-6. The regional navigation was mixed with main navigation. In the searched web page, there is only one main menu navigation. However, if navigations of a site are divided into main navigation, sub navigation and service navigations, users may not be lost while using it (Krug, 2007). Everything will be clear as it is done, for persons who use the site for the first time. Every web page or a program may look like useful as it is used many times. Users get used to using it. But, in this case the efficiency of the site decrease and then persons may not use or visit the site.

As the sticker's names in navigation bars are named accurately, the users may not be lost while using the web site. So the time required reaching to desire outcome decreases and usability of that site increases automatically. For most of the cases in this study, navigations are named correctly. But, in task-3, users reached to desired objective with 25% success rate because of wrong naming in navigation menu bar. So, the names of menu should help users to guess what would be coming tab.

From this study, it is understood that users lost their ways in the site as the link is directed to a new tab. Using new tabs with different page design makes users to think about and try to understand the new features of the site. This creates a conflict in using site. Moreover, in most of mobile devices, it is not as easy to go back the other tab as using in PC. In order to solve such problem, new tab could be opened over old one. So, users could go back to previous page by using back button. In addition, in some smartphones, the number of using new tab was limited to eight tabs as in iPhones. If user had already opened some tabs before, it would be difficult to go forward in the applications. So, in order to not to have such problems, all of the web site of universities should be designed by using templates as created at Atatürk University. Templates for PC and mobile devices should be developed and used.

The web site searched in this study was designed for computer systems with big screen size. Some properties of it are not suitable for mobile phones. Using some photos or pictures with high resolutions in home pages may not create a problem in PC screens. However, having such property in the site causes usability problems in mobile smart phones. Users might not observe local navigation placed at the bottom because of screen size. Font size for mobile device should also be selected according to screen size. When page is designed just according to properties of PC, it would be difficult to use it in small devices like phones or tablets. Results of this study support the literature in the number of click to achieve desired outcome. If the number of click was more than three, users get bored and leave the site without using. So, tasks should be accomplished maximum in three steps (Porter, 2003).

It is cleared that in order to use web sites properly in new generation electronic devices like smartphones and tablet computer, the designers had better take care in designing the web site compatible for mobile devices to avoid distinction in using web site in mobile devices. Websites have to develop alternate mobile designs. Moreover, templates for PC and mobile devices should be developed and used. In addition, font size for mobile device should also be selected according to screen size. Some standards have to be applied in designing web site for mobile devices. These standards could be: using single column layouts work best, presenting navigation differently, reducing the amount of content, minimizing text entry, designing for touchscreen and non-touchscreen users, and taking advantage of inbuilt functionality (Apple, 2013; Sherrett & Terrill, 2012; Webcredible, 2013).

From this study, it is understood that participants could not completed with high success rate, if task is asked to find any information not related with students. Student could not manage the task. Doing research with the same type of participant (being student) was one of the limitations of the study. The same study might be repeated by using different types of mobile devices with more than one university with more participants.

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