# Web Site Usability Measurement: A Case of Fatih University

**Mehmet Salih Goceri**
Management Information System
Santa Clara University
Santa Clara, CA, 95051, USA
mgoceri@scu.edu

**Tugba Goceri**
Santa Clara, CA, 95051, USA
tbgoceri@gmail.com

## Abstract

The usability evaluation of a web site has been found using quantitative metrics. A case study has been used to collect quantitative data from participants to determine and measure 3 main factors of web site usability; effectiveness, efficiency, and satisfaction. A questionnaire has been delivered to 32 participants and they were asked to complete 8 tasks which have been determined to navigate the web site. The results of the study produced an enriched perspective to measure the web site usability. We measured the effectiveness, efficient, and satisfaction with quantitative data and explored the weakness of each factor.

**Keywords;**
Usability, Usability Evaluation Metrics, Usability Measurement Techniques, Web Site Evaluation, Usability Problems, Effectiveness, Efficiency,

## 1. Introduction

Developing a highly qualified, well designed, and usable web site is one of the most complicated issues in online world. Users of the web site have different purposes and they are free on selection of the web sites (Nam, 2014). Web sites can be categorized into four groups; entertainment, information, communication, and commerce (Lee and Koubek, 2010).

However, most of the web sites contain many problems in terms of usability (Becker and Mottay, 2001, Chau and Wong, 2010, Treiblmaier and Pinterits, 2010, Tung et al., 2009). The common problems can be defined as difficulties of understanding the content, difficulties in navigation, disorientation, lack of customization, reliability, consistency and so on (Downing and Liu, 2011; Fogli and Guida, 2014).

Number of studies related to usability tremendously increased year by year since 1997 compared to relative areas such as human computer interaction, software, and web engineering. (Fernandez et al., 2011). While the number of usability studies has been increasing, the definition of it has been changed as well. Usability is defined as ‘‘the capability to be used by humans easily’’ (Shackel, 1991, p. 24); and "...the ease of use and acceptability of a system or product for a particular class of users carrying out specific tasks in a specific environment"(Bevan, 1991). Usability has been defined differently by researchers because of its context. Additionally, new methods regarding measuring web usability have been introduced over the time. Researchers and practitioners used different methods to measure web sites’ usability. There are two type of methods could be used for usability evaluations: Quantitative methods such as eye tracking methods, remote evaluations, laboratory analysis, surveys and qualitative methods such as interviews and think aloud methods.

In this study, we used a survey in a designed room where we recorded the videos, took notes and measured the performance of each user for evaluation of a web site's usability. Participants completed 8 tasks and answer the questions. Afterwards, we analyzed the data collected from participants and determined the level of usability of the web site.

## 2. Literature Review

Usability is defined as ''the capability to be used by humans easily'' (Shackel, 1991, p. 24); and "...the ease of use and acceptability of a system or product for a particular class of users carrying out specific tasks in a specific environment"(Bevan, 1991), "designing software applications which people find convenient and practicable for use "(Nielsen, 1993).

In other words, usability has been defined differently by many researchers. For example, Hornbeak defines usability it as "The effectiveness, efficiency, and satisfaction with which specified users can achieve goals in particular environments" (Hornbeak, 2006) while it is stated as "*the performance achieved and satisfaction experienced by system users"* by Wagner (Wagner et al., 2014). Definition of the International Standardization of Organization, (ISO) is accepted as one of the most common definition of usability in literature, which is ''*the extent to which intended users of a product achieve specified goals in an effective, efficient and satisfactory manner within a specified context of use''* (ISO 9241).

The necessity for evaluation of quality and usability of the web sites has been discussed on many articles (Oztekin et al., 2009, Elling et al., 2012). There are many approaches developed to assess the quality of web site and their usability. The methods to evaluate the web site usability also have been proposed differently due to lack of consensus on either usability factors or evaluation methods (Oztekin et al, 2009, Fogli and Guida, 2014). In this context, usability evaluations depend on the purpose of the evaluation, limitation of resources, and preference of researchers (Fernandez et al., 2011). As seen above-definitions, usability can be classified into three dimensions: effectiveness, efficiency, and satisfaction. In order to measure the usability of a web site, those three dimensions need to be considered.

In this study, we took into account those three dimensions in order to understand the usability level of the web site. A case study has been performed to collect the quantitative data which has been used for the analysis.

## 3. Proposed Methodology

In the proposed methodology, firstly, we aimed to collect sample data from representative end-users to measure the usability of a web site. A university web portal has been selected for the measurement. A case study has been applied to measure the usability of a web site. The data is collected using a survey which asks users to about usability of the web portal has been delivered to participant who has been asked to complete some tasks first then answer the questions in survey. There are 8 tasks have been defined for the participants as follows:

Task 1: Please log in to student portal.
Task 2: Please find out how many hours you are available on Thursday on your school schedule.
Task 3: Please read the last message coming from the university and mark it as "read".
Task 4: Please help one of your foreign friends who asked you to help him/her to change the language of the system to English.
Task 5: Please find the details of a course you take this year.
Task 6: Please find the place in the system where your GPA is recorded.
Task 7: Please make a reservation for Thursday at the fitness room.
Task 8: Please log out from the student portal.

Number of tasks has been increased compared previous studies in order to allow users to spend time on the web site then answer the questions. 32 students of the university have been selected randomly by inviting them to the process. Participants have been reported to their professor to be graded. Additionally, participants have been offered snacks during the survey.

Before the process, we explained them; what they will do; what they can do, so that they could feel comfortable during the process.


Figure 1 An example of user testing in a specific room

While participants complete the survey, we collected completion time of each task per person. We recorded each participant's completion time. Task's completion time has been calculated by averaging the experts' and novice users' completion times. Experts are defined as who has experience on the web portal more than 3 years; non-experts (novice) users are defined people who never used the web portal. We added some extra time to the averages to make sure every participant had enough time to complete the tasks. The updated limits produced a great perspective for us about task completion time for regular users.

We measured the effectiveness, efficiency and satisfaction separately in order to measure the usability of the web portal. We determined efficiency as how fast they can achieve the desired task compared to updated-limits. To measure effectiveness, we looked whether a participant completed tasks or not. We categorized them also as Success without help, success with small help like using one word or two, success with help such as giving them some clues (H2), and Failure; not completed. If they completed within the range, it is successful, if s/he cannot finish the task within the range, s/he fails. Additionally, at the end of surveys, we asked participants to express the level of satisfaction from the system usage. Finally, we got average of satisfactions and determined the level of users' satisfaction.

## 3. Results

A total of 8 experienced and 8 non-experienced participants completed tasks. After, determining the limit of each task, 30 participants completed the surveys and tasks. 2 participants could not either finish the survey or tasks accordingly and they have been eliminated from the analysis.

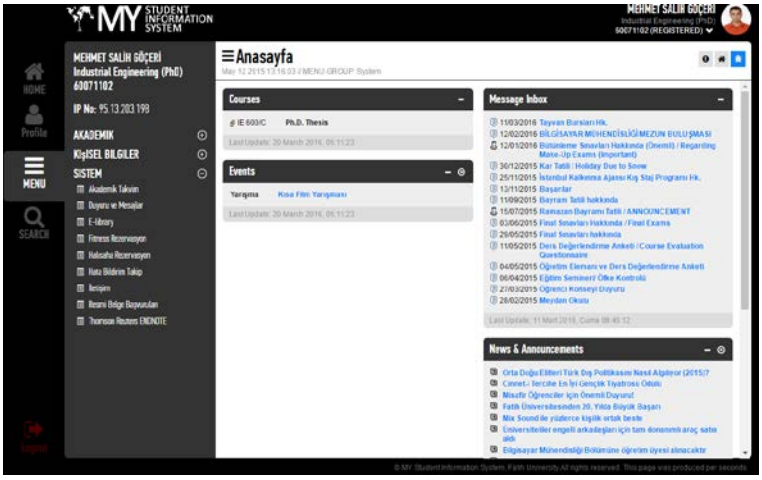


Figure 2. Design of student portal

## 3.1 Efficiency

Efficiency shows how fast and easily user can achieve the tasks. As seen in the table 1, 30 participants completed the tasks as follows:

Table 1. Task completion time by participants and efficiency of tasks

| PARTICIPANTS | TASK 1 | TASK 2 | TASK 3 | TASK 4 | TASK 5 | TASK 6 | TASK 7 | TASK 8 |
|---|---|---|---|---|---|---|---|---|
| Experienced Av. | 10 | 17.8 | 14.4 | 15.2 | 4.7 | 2.4 | 8.8 | 1.8 |
| Inexperienced Av. | 33.2 | 21 | 39.9 | 46.5 | 67.9 | 29.2 | 45.7 | 5.5 |
| Average of Ex and InEx. | 21.6 | 19.4 | 27.1 | 30.8 | 36.3 | 15.8 | 27.3 | 3.7 |
| Updated limits | 26.6 | 24.4 | 32.1 | 35.8 | 41.3 | 20.8 | 32.3 | 8.7 |
| P1 | 21.4 | 18.3 | 18.9 | 7.9 | 6 | 15.5 | 7.9 | 2.3 |
| P2 | 11.4 | 18.43 | 28.13 | 52.4 | 17.14 | 64.28 | 19.32 | 4.2 |
| P3 | 12.41 | 14.6 | 18.39 | 39.32 | 21.23 | 73.11 | 25.15 | 3.32 |
| P4 | 18.3 | 6.5 | 12.4 | 31.2 | 20.2 | 6.9 | 9.1 | 4.4 |
| P5 | 21.5 | 7.1 | 15.9 | 36.1 | 21.4 | 7.5 | 8.7 | 4.5 |
| P6 | 25.2 | 9.1 | 13.2 | 49.9 | 17.4 | 8.8 | 11.2 | 4.3 |
| P7 | 36.6 | 10.1 | 15.4 | 33.6 | 38.9 | 7.9 | 13.2 | 3.2 |
| P8 | 40.1 | 7.8 | 16.4 | 29.1 | 14.6 | 6.8 | 6.7 | 2.1 |
| P9 | 11 | 5 | 25.23 | 68.17 | 8.56 | 41.35 | 19.34 | 3.5 |
| P10 | 9.13 | 6.8 | 11.3 | 20.43 | 15.36 | 19.41 | 26.5 | 3.4 |
| P11 | 18.45 | 3.45 | 8.32 | 34.65 | 32.2 | 13.4 | 14.45 | 5.85 |
| P12 | 12.15 | 4.13 | 9.17 | 71.15 | 18.21 | 4.32 | 23.29 | 6.12 |
| P13 | 30.45 | 24.52 | 49.17 | 55.49 | 15.99 | 10.15 | 24.45 | 8.63 |
| P14 | 31.6 | 4.3 | 14.5 | 19.3 | 8.5 | 6.3 | 10 | 5.1 |
| P15 | 24.9 | 10.1 | 13.2 | 30.1 | 2.8 | 6.8 | 11.6 | 7 |
| P16 | 31 | 9.3 | 11.4 | 8.7 | 5.3 | 3.7 | 17.4 | 3.8 |
| P17 | 22.5 | 6.8 | 23.3 | 7.6 | 28.3 | 4.7 | 7.5 | 2.1 |
| P18 | 34.59 | 10.61 | 9.51 | 28.75 | 6.09 | 11.29 | 13.62 | 5.6 |
| P19 | 90.41 | 6.36 | 27.96 | 36.97 | 3.87 | 10 | 16.15 | 7.09 |
| P20 | 27.86 | 11.88 | 18.79 | 72.1 | 15.81 | 7.12 | 9.79 | 5.74 |
| P21 | 26.16 | 5.59 | 15.12 | 61.01 | 15.59 | 6.18 | 9.79 | 7.64 |
| P22 | 36.56 | 12.81 | 41.91 | 34.98 | 8.99 | 4.79 | 20.4 | 9.22 |
| P23 | 21.12 | 11.81 | 38.45 | 29.33 | 7.79 | 5.43 | 7.2 | 9.22 |
| P24 | 13.1 | 10.4 | 45.1 | 31.1 | 47.5 | 22.4 | 11.5 | 5.4 |
| P25 | 13.2 | 11.5 | 15.1 | 23.5 | 45.2 | 28.4 | 12.1 | 5.1 |
| P26 | 14.32 | 5.36 | 11.18 | 53.17 | 15.45 | 6.31 | 82.16 | 6.11 |
| P27 | 54.49 | 7.17 | 33.15 | 31.34 | 12.11 | 6.82 | 38.53 | 10.01 |
| P28 | 17.1 | 12.4 | 8.1 | 4.2 | 0.1 | 25.4 | 10.1 | 7.2 |
| P29 | 15.41 | 9.1 | 25.2 | 19.3 | 51.2 | 27.5 | 36.4 | 3.9 |
| P30 | 15.5 | 23.4 | 35.1 | 21.3 | 56 | 19.5 | 32.5 | 9.2 |
| Average of Participants | 25.3 | 10.2 | 21 | 34.7 | 19.3 | 15.7 | 18.5 | 5.5 |
| Limits of Each Task | 26.6 | 24.4 | 32.1 | 35.8 | 41.3 | 20.8 | 32.3 | 8.7 |
| Difference | 1.3 | 14.2 | 11.1 | 1.1 | 22 | 5.1 | 13.8 | 3.2 |
| **Efficiency of Each Task** | **4.8872** | **58.197** | **34.5794** | **3.0726** | **53.269** | **24.5192** | **42.7245** | **36.782** |
| **Total System Efficiency** | **32.254** | | | | | | | |

Red-pink colors reflect unsuccessful participants.
Yellows are within range but incompletes.
Greens are within range with H1.
Blues are within range with H2.

We calculated efficiency of each task by dividing difference with limits of each tasks. Difference shows the time remaining still to limit of each task. As seen in in Table 1, difference for Task 1 is 1.3 seconds which explain that, task 1 has been completed by participants in 25.3 seconds averagely, and it is less than 1.3 averagely from the limits. Participants completed Task 1but very slowly. Additionally, in Task 5, participants completed the task 5 in 19.3 averagely, however, limit is 41.3 which means they completed Task 5 using the 46.77% of the time allowed. So efficiency is 53.27. The most efficient tasks are 2, 5, 7, and 8 respectively. System efficiency has been found 32.25% which can be accepted less for web portal. That explain that users cannot easily achieve their goals on the web portal and web portal efficiency needs to be improved. Less efficient tasks must be improved in order to the increase the efficiency of the web site.

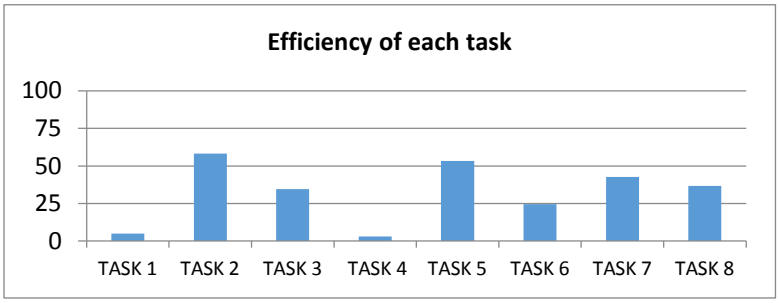


Figure 3. Efficiency of each task

## 3.2 Effectiveness

Effectiveness shows whether participants were able to complete the tasks or not within the time range. We have calculated effectiveness of each task using Table 1 and we have determined the effectiveness as follows:

Table 2. Tasks with success rate

| Tasks | Success (within range) | Unsuccessful |
|---|---|---|
| T1 | 20(66.7) | 10(33.3) |
| T2 | 29(96.7) | 1(3.33) |
| T3 | 23(76.7) | 7(23.3) |
| T4 | 16(53.3) | 14(46.7) |
| T5 | 24(80) | 6(20) |
| T6 | 22(73.3) | 8(26.7) |
| T7 | 26(86.7) | 4(13.4) |
| T8 | 25(83.7) | 5(16.7) |

Table 1 includes tasks completed by participants successfully and unsuccessfully. If we go deeper to see whether they get any help during the tasks and how the category of help is, we have generated the Table 3. H1 reflects only a word or two words help during the tasks, but H2 reflects more than 2 words, such as giving clues and comments, tell them something if they need.

Table 3. Tasks with success rate with H1 and H2

| | Success (without help) | H1 | H2 | Unsuccessful |
|---|---|---|---|---|
| T1 | 20(66.7) | 0 | 0 | 10(33.3) |
| T2 | 29(96.7) | 0 | 0 | 1(3.33) |
| T3 | 19(63.3) | 4(13.4) | 0 | 7(23.3) |
| T4 | 14(46.7) | 2(6.66) | 0 | 14(46.7) |
| T5 | 24(80) | 0 | 0 | 6(20) |
| T6 | 22(70) | 1(3.33) | 0 | 8(26.7) |
| T7 | 26(83.4) | 0 | 1(3.33) | 4(13.4) |
| T8 | 25(83.7) | 0 | 0 | 5(16.7) |
| Total | 177(73.75) | 7(2.9) | 1(0.4) | 55(22.9) |
| System Effectiveness | **77.1** | | | |

As seen in Table 3, task 4, 1, 6, and 3 are the most unsuccessful tasks while task 2, 8, 7, and 5 are the most successful tasks respectively.

This confirms that efficiency of the tasks as well because if we look at the most efficient tasks, they are 2, 5, 7, and 8 which are the most effective tasks. Total system effectiveness can be calculated by taking average of successful tasks which is 77.1%. This explains that 77.1% of tasks have been completed successfully and system is effective overall by 77.1%. Web portal needs to improve its effectiveness by changing designs of the page, making links clear for users' inceptions and so on. Thus, effectiveness of the web portal could be increased. Additionally, in order to increase the efficiency of the web site, tasks, where users have less success, must be considered first as where users experience hard time to achieve their goals.

### 3.3 Satisfaction

We asked the participant to rate the system from 0 to 100 regarding how satisfied they were while using the system. As seen in the table 4, satisfaction of the system has been found %67.6. Satisfaction level depends on each person but 67.6% is less for a web portal. This shows that users are not that much satisfied while using the web portal.

Table 4. Satisfaction of system usage

| Participants | Overall Satisfaction | Participants | Overall Satisfaction | Participants | Overall Satisfaction |
|---|---|---|---|---|---|
| 1 | 70 | 11 | 60 | 21 | 80 |
| 2 | 60 | 12 | 45 | 22 | 65 |
| 3 | 50 | 13 | 76 | 23 | 75 |
| 4 | 75 | 14 | 75 | 24 | 65 |
| 5 | 70 | 15 | 60 | 25 | 60 |
| 6 | 90 | 16 | 75 | 26 | 68 |
| 7 | 65 | 17 | 67 | 27 | 55 |
| 8 | 80 | 18 | 60 | 28 | 70 |
| 9 | 60 | 19 | 87 | 29 | 75 |
| 10 | 50 | 20 | 50 | 30 | 90 |
| System Satisfaction | | 67.6 | | | |

## 4. Conclusion

The results of the usability measurement of the Fatih University web portal were extremely useful. Web site usability measurement is something that should be done by each web site owner. These studies could provide valuable information and perspective for any institutions regarding their online face. Incorporating usability testing into website redesigns will lead to user-centered websites, which means more attractive and functional web site for users. Reviewing of the camera recorders and notes provided a great insight regarding the strengths and weaknesses of the web portal so that we were able to see how to improve the web portal. Additionally, quantitative measurement helped to see the real performance of web site from usability perspective. Measuring efficiency, effectiveness and satisfaction with quantitative methods produced an enrichment insight for the usability of the web portal.

The main weakness of the study was to lack of the quantitative measurement. This part could be an excellent starting point for further research.

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## Biography

**Mehmet Goceri** is a PhD candidate from Istanbul University, from Industrial Engineering Department. He was lecturing at Fatih University from 2014 to 2016 in Foreign Trade and Industrial Engineering Department. He earned B.S. in Industrial Engineering from Istanbul University, Masters from Fatih University in Industrial Engineering. He taught some courses in Santa Clara University in California. He has published journal and conference papers. His research interests include manufacturing, optimization, scheduling, usability, and user experience.

**Tugba Goceri** is currently is a Master candidate from Industrial Engineering Department. She earned B.S. in Mathematics from Fatih University, She published some conference papers. Her research interests include usability, user experience, and decision making science.