THE INVESTIGATION OF USABILITY ISSUES OF FACULTY
DEVELOPMENT PROGRAM (FDP) INFORMATION PORTAL

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ABSTRACT

THE INVESTIGATION OF USABILITY ISSUES OF FACULTY DEVELOPMENT PROGRAM (FDP) INFORMATION PORTAL

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This study aims to investigate the usability issues of FDP (Faculty Development Program) Information Portal in regard to the users' opinions in the university in Ankara. In order to measure the usability of the Information Portal, a mixed method study including questionnaires, eye-tracking, interview was conducted. Quantitative data of the questionnaire including Computer Literacy Scale, System Usability Scale (SUS) and Questionnaire for User Interaction Satisfaction (QUIS) were collected from 100 FDP students in the university. After obtaining quantitative data, Think-Aloud Method which is a method of Eye-Tracking Methodology was conducted with 5 FDP students in Human-Computer Interaction Laboratory. The subjects' eye movements were recorded with an eye tracker while they were performing the four main tasks on the portal. Additionally, their voices were recorded with a microphone. In the study, the significant mean difference was found only in satisfaction means in regard to institute types. The satisfaction mean difference between genders was not significant. Moreover, the usability mean of FDP information system is not significant both between genders and institute types. It was also found that the most negative aspect of the portal were *lack of system content* and *lack of guide*, and the most positive aspect was *easy access to the portal*. In usability test, by taking CTA and eye-tracking into account, two important problems were found. The first problem

was menu and interface problems, and the second problem was lack of descriptive content about account area. Considering the answers of the subjects during the interviews conducted after the usability test, some recommendations were made to improve FDP Information Portal.

Keywords: Information System, Effectiveness, Usability, Human-Computer Interaction, Eye-Tracking, Think-Aloud

ÖZ

ÖĞRETİM ÜYESİ YETİŞTİRME PROGRAMI (ÖYP) BİLGİ SİSTEMİNİN KULLANILABİLİRLİK SORUNLARININ İNCELENMESİ

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Bu çalışmanın amacı, Öğretim Üyesi Yetiştirme Programı (ÖYP) Bilgi Sisteminin kullanılabilirlik sorunlarını kullanıcıların görüşlerini alarak değerlendirmektir. Bilgi sisteminin etkinliğini ölçmek için, anket, göz-izleme ve görüşme veri toplama yöntemlerini içeren karma yöntem kullanılmıştır. Bilgisayar Okur-yazarlığı ölçeği, Sistem Kullanılabilirlik ölçeği ve Kullanıcı Ara yüz Memnuniyet ölçeğini içeren anketin nicel verileri üniversitede bulunan 100 ÖYP öğrencisinden toplanmıştır. Nicel veriler toplandıktan sonra, Göz izleme metodolojisinde kullanılan olan Sesli Düşünme yöntemi 5 ÖYP öğrencisi ile İnsan-Bilgisayar Etkileşimi Laboratuarında gerçekleştirilmiştir. Denekler portal üzerinden 4 ana görevi gerçekleştirirken, göz hareketleri göz izleyicisi tarafından kaydedilmiştir. Ayrıca, sesleri de bir mikrofon ile kaydedilmiştir. Çalışmada anlamlı farklılık sadece enstitü tiplerinin memnuniyet derecelerinde çıkmıştır. Cinsiyetler arasında, memnuniyet derecelerinde anlamlı bir fark çıkmamıştır. Bunun yanında, ÖYP Bilgi Sistemi'nin kullanılabilirliği hem cinsiyetler arasında hem de enstitü tipleri arasında anlamlı bir fark yaratmamıştır. Ayrıca, çalışmada portalın olumsuz yönü *sistem içerik ve yardım eksikliği,* olumlu yönü ise *portal'a kolay erişim* olarak bulunmuştur. Kullanılabilirlik testinde, Eş Zamanlı Yüksek Sesle Konuşma yöntemi, ve Göz-İzleme metodolojisi dikkate alındığında, sistem ile ilgili iki önemli problem bulunmuştur. Bunlardan birincisi

menü ve arayüz problemi, ikincisi ise muhasebe ile ilgili açıklayıcı bilginin eksikliğidir. Ayrıca kullanılabilirlik testi sonrası uygulanan görüşmede, deneklerin cevapları göz önünde bulundurularak ÖYP Bilgi Sistemi ile ilgili kullanılabilirlik önerileri sunulmuştur.

Anahtar Kelimeler: Bilgi Sistemi, Etkinlilik, Kullanılabilirlik, İnsan – Bilgisayar Etkileşimi, Göz-İzleme, Sesli Düşünme

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LIST OF ABBREVIATIONS

FDP   : Faculty Development Program

HCI   : Human- Computer Interaction

HEC   : Higher Education Council

IS   : Information System

METU   : Middle East Technical University

SPO   : State Planning Organization

CEIT   : Computer Education and Instructional Technology

CTA   : Concurrent Think-Aloud

Users   : In the study, 'users' are FDP students at METU in Ankara

CHAPTER 1

INTRODUCTION

Recent developments in Information and Communication Technologies (ICT) resulted with common use of Information Systems for organizations' operational task. Information system (IS) is means that help transmit, retrieve, store, process and display of information (Saeidi & Marzban, 2013). Information system is commonly used in many organizations and the more usage of IS is related to its benefits to the organizations. However, the benefits to the organizations are obtained from an useful information system.

To take advantage of benefits of IS, Information System - Faculty Development Program (FDP) Information Portal - was designed and developed under the leadership of Research Coordination Office where is in the President Building in Middle East Technical University (METU) in Ankara and its design and development were completed in 2011. FDP program was conducted with the cooperation of State Planning Organization (SPO) and METU until 2010. Furthermore, starting from 2010, the FDP program has been run by Higher Education Council (HEC) and the scope of the program has been widened. The FDP Information Portal has been used by FDP students, their advisors, their department chairs, the institutes, and FDP officers in the university. The general aim of portal is to provide FDP students inform operations to use their budgets provided systematically by the SPO, reach the news and the needed documents about the FDP, and provide FDP officers to monitor the use of students' budgets.

In this study examines the usability issues of FDP Information Portal in regard to the users' opinions in the university. There are 270 FDP students using the portal; however, 181 new FDP students do not use the portal because of their different budget source that is from HEC. A new FDP Information Portal will be created for

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the new FDP students and this study helps have an idea for the new FDP Information Portal to be created. In short, the study will help to understand the usability issues of the FDP Information Portal and also gives hints that shows what to do or not to do for the new portal that will be created for the new FDP students.

This chapter starts to provide information about background of the study, statement of the problem, purpose of the study, the research questions and significance of the study. Assumptions, limitations, and delimitations are also provided.

1.1. Background of the Study

In 1994, Macleod studied on usability of information system by using MUSiC (Measuring Usability of Systems in Context) method including Usability Context Analysis (UCA). The method includes monitoring chosen users in controlled studies, performing tasks identified as a result of UCA. Especially, it was emphasized that users who are chosen to evaluate the system needed to match the user characteristics. In his study, to measure the usability of the system the users were taken into consideration. It was pointed that adding the graphical interface to the system do not solve the usability problems and also the user opinion and user characteristics are important determinant of the usability. Unlike Macleod, in 1996 Ragowsky, Ahituv and Neumann did not study directly usability of information system. They tested an approach for evaluating the benefit to the organization gained by the use of an individual information systems application. They found that despite using the same information system applications, different organizations gain different benefits by them. Similarly, Weber and Pliskin (1996) studied on information systems in organizations. They tested the relationship between the integration of information systems during mergers and acquisitions and their effectiveness. In their study, the organizational culture was paid attention and it was found that in the effective implementation of information system integration, organizational culture plays an essential role. Information systems in organizations were investigated in studies with regard to their benefits, usability and the relationship between organization cultures.

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In addition to these studies, Li (1997) studied on the factors affecting information system success. Seven new factors were added to the well- known Bailey and Pearson (1983) information system success instrument including thirty-nine factors. By conducting questionnaire, the top five important factors that are accuracy of output, reliability of output, relationship between users and the computer-based information system staff, user's confidence in the systems, and timeliness of output, were determined . Another study was done by Ranganathan and Kannabiran (2004), they studied on how Indian organizations are designing their information system functions and the critical parameters contributing to effective performance of the information system function were identified. In the study, the qualitative case-study approach was used. The research includes recommendations for effective design of information system function.

Furthermore, Kassim, Jailani, Hairuddin and Zamzuri (2012) researched the role of trust mediating the relationship between information system acceptance and user satisfaction. In the study, six constructs which are information quality, system quality, ease of learning, ease of use, trust and satisfaction were measured. It was suggested that ease of learning is related to ease of use, ease of use and information quality are the determinant of trust and trust mediates the acceptance and satisfaction relationship. In the same year, Edelhauser (2012) studied on the use of Human Resource Information System (HRIS) used in Romanian organizations. The aim of the study was to measure the impacts of contingency factors, including size, and success of the HRIS. In the study, thirteen organizations were investigated and both quantitative and qualitative instruments were used. After the investigation, two main conclusions were reached. Firstly, management information system play a essential part in the success of an organization and secondly the success of an information system should be analyzed only owing to its efficiency. Finally, Alhendawi and Baharudin evaluated impact of the Web-based Information System' (WBIS) quality factors that are system quality, information quality and service quality on the employee's contextual performance. To collect the data, questionnaire was used. It was found that there are strong correlations among model's factors.

The related research studies findings indicate that some of the determinants of the usability of an IS are user characteristics, organizational culture, usage-performance relationship, information quality, system quality, easy of learning, ease of use, and user satisfaction. Moreover, the studies investigated the usability, effectiveness/success of information system by using similar data collection instruments. Namely, only the quantitative data was obtained and evaluated. However, it is needed to evaluate the usability issues of the information system by collecting both quantitative and qualitative data. For detailed analysis, both of the data are needed because they give supplemental information for each other. Finding the result from the questionnaire is not sufficient because the reasons of the low scores in the questionnaire should be analyzed. In this way, the study provides benefit to the ones measuring the usability. Moreover, measuring the usability of the system in the same context in terms of users' opinions is important. For this, Human-Computer Interaction (HCI) helps the process. Performing actual tasks helps finding the unknown/difficult problems of the system. Thanks to the Eye-tracking method used in HCI field, eye-movements of the user are analyzed. To reach the proper result of the information' usability issues, detailed analyzed is needed. Otherwise, the study gives only a clue for the usability of the system.

The intent of the study is to investigate usability issues of FDP Information Portal in regard to the users' opinions and eye-tracking. To measure usability of the FDP Information Portal, the questionnaires that are Computer Literacy Scale, System Usability Scale (SUS), Questionnaire for User Interface Satisfaction (QUIS) were conducted first. After, Eye-Tracking method was used in Human-Computer Interaction Laboratory as creating actual context for the actual user. In eye-tracking method, while the subjects who are FDP students were performing the actual tasks in the information system, their eye movements were monitored by Tobii Studio software which is Eye Tracking software for analysis. Moreover, In Eye-Tracking method, Concurrent Think-Aloud (CTA) technique was used. While the subjects were performing the tasks, they thought aloud, verbalized their thoughts and at the same time the software recorded their voices and this process gave a clue about what their minds. At the end of the tasks, the semi-structured interview was conducted.

1.2. Statement of the Problem

The general aim of FDP Information Portal is to provide FDP students use systematically their budgets given from the SPO. The FDP budgets are used by the FDP students for two purposes that are doing project and going to academic travel. After the purpose is selected, a request about the purpose is created in FDP Information Portal and it is sent to the advisor for approval. After the advisor, the department chairs, the institutes, and FDP officers gives approval respectively for the request by using the portal. Moreover the FDP students reach the news about the FDP and their budgets information and the needed documents about the FDP.

However, the usability of the system has not been evaluated in regard to the system users. Following conditions indicate that there is a need of measurement of usability issus of the FDP Information Portal :

- FDP students send mail or telephone to the FDP officers for basic tasks in FDP Information Portal. Generally, the tasks are about how to be controlled the budget or how to be created a project request or an academic travel request. The students wants the officers to create the request with them via telephone. These mails, telephones prevent the officers from doing their daily works.

Therefore, there is a need to investigate the usability issues of FDP Information Portal to provide system with feedback.

1.3. Purpose of the Study

The purpose of the study is to
- Investigate the usability issues of FDP Information Portal in regard to the FDP students opinions and eye tracking .

1.4. Research Questions

The study addresses the following four questions:

1. What are the FDP students satisfaction levels about the FDP Information Portal in terms of their genders and institute types which are GSSS (Graduate School of Social Sciences) and GSNAS (Graduate School of Natural and Applied Sciences) ?

    1.1. What are the negative and the positive aspects of the FDP Information Portal according to the FDP students?

2. What is the FDP Information Portal' Usefulness Score in terms of FDP students' genders and institute types which are GSSS and GSNAS?

3. Is there a relationship between the FDP Information Portal' Usefulness Score and the FDP Students Satisfaction Levels?

4. What are the usability problems of the FDP Information Portal according to the FDP students when they perform the four main tasks (creating a project request, finding the "Proje Onay Süreci" graph, creating an academic travel request and finding the "Yurtiçi ve Yurtdışı Görevlendirme Yönergesi" document) on the portal?

    4.1 What are the usability suggestions of FDP students about FDP Information Portal after the usability test?

1.5. Significance of the Study

The study is significance in terms of three reasons provided below:

– This is the first time that the usability of the FDP Information Portal as Information System (IS) is investigated since it was developed. To increase the usability of the portal, it is important to find the reasons preventing the usability.

– The FDP Information Portal has been used by 270 FDP students; however, 181 new FDP students do not use the portal because of their different budget source,

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HEC (The Higher Education Council). The findings of this study would provide input for either to add new component to the FDP portal, or to develop a new system for new FDP students.

− In Information System literature, there are many studies investigating the usability of the information system. To measure the usability of IS most studies conducted only one data collection method and it was mostly questionnaire or interview. Using only one type of method provides limited results about the usability. However, to find the reasons/factors that affect the usability an in depth study is needed. In this study, multiple data collection methods that are Computer Literacy Scale, System Usability Scale (SUS), Questionnaire for User Interface Satisfaction (QUIS), Eye-Tracking (Concurrent Think-Aloud method) and semi-structured interviews methods were conducted. In Eye-Tracking method, Concurrent Think-Aloud (CTA) technique was used. While the subjects who are FDP students were performing the actual tasks on the FDP Information Portal, they verbalized their thoughts and at the same time the software recorded their voices. This process gave a clue about what are in their minds. By this way, both effectiveness measures of the system and the underlying reasons of the effectiveness measures in regard to the cognitive processes that underlie a specific action can be exposed (McCorry, Scullion, McMurray, Houghton, & Dempster, 2013). The findings from different data sets such as qualitative data and eye-tracking data would provide information on underlying reasons of usability of the system examined as well as contribute to the related literature.

1.6. Assumptions

These following assumptions were accpedted in the study,
− The participants filled the questionnaires accurately.
− The participants responded the interview questions honestly.
− The data were collected and recorded appropriately.
− The measures in the study were reliable and valid to make accurate results

1.7. Limitations

This study has the following limitations,

– The participants will answer the questions of the interview sincerely.The sample size will be limited to the graduate students who use the system.

– Responses are limited by the participants' willingness to join the instruments.

– The validity of this study is limited to the honesty of the subjects' responses to the instruments used in the study.

– Because of the limited number of FDP students, both Graduate School of Informatics and Graduate School of Applied Mathematics are removed the study. The study included only the students at Graduate School of Natural and Applied Sciences and Graduate School of Social Sciences.

1.8. Delimitations

The study has the following delimitations,

– The study will be limited to FDP students using the FDP Information Portal at METU in Ankara.

– The usability of FDP Information Portal will be assessed by its usability and the FDP students' satisfactions.

CHAPTER 2

LITERATURE REVIEW

This chapter provides a review of literature related to the study. To investigate the usability issues of Faculty Development Program (FDP) Information Portal – requires understanding the some topics that are definition of information system (IS), usage of information system in organization, benefits of information system, effectiveness of information system, usability of information system, measuring information system usability, user characteristics, user satisfaction, Human-Computer Interaction (HCI) in usability, eye-tracking methodology in usability, and think-aloud method in eye-tracking methodology.

2.1. Definition of Information System (IS)

The various definitions of information system (IS) are made because of having different perspectives. The objective of using the IS affects the definition. The general and short definition of IS was made by Von Hellens (1997) by contrasting the IS with software, he described that software generally is defined as program; however, an information system is the organization context that software is used. Contrary to the general definition, there are detailed definitions made in terms of both technical and socio-technical perspectives.

When looking at technical viewpoint , information system is a lasting system that handle collecting, processing, storing and distributing information in order to help organization's decision making and authority (Saeidi & Marzban, 2013). Moreover, according to Lee and Yu (2012) information system stores, maintains, processes and manages information sources and it provides people to make useful decision. In technical perspective, the definition of information system includes its role in processing of information in the organization. In other words, both definitions

include providing needed information to the organization and the steps of using information to provide decision making.

On the contrary, when looking at socio-technical perspective, an information system is seen in a general composed of the people and the work process that they have to accomplish with a technology (Au, Ngai, & Cheng, 2002). Moreover, Whitten, Bentley and Dittman (2004) made socio-technical definition , they integrate the "people" into their definition. They defined that information system is an adjustment that includes people, data, processes and information technology and it acts together to collect, process, store, and provide the information that is needed in order to support an organization. David and Olson (1985) use this integration to the their definitions by using "user" in spite of "people". They defined that information system is an integrated and user-machine system in order to provide organizations with information that is needed to support operations, management and decision making action. In this perspective, the definitions involve not only technical viewpoint but also socio viewpoint including "people".

Except these definitions, Auramaki and Hirschheim (1992) took communication into consideration in information system definition. They stated that information system is as a communication means between different people both spatially and temporally distant. In this point, Beynon-Davies (2009) emphasized that an information system is basically about to communication supporting human activity that use artefacts in order to represent, store, manipulate and transmit data. The most basic of an information system does not only depend upon the technology or the activity, it lies in the way that technology is used to give a support for purposeful action. Moreover, Beynon-Davies (2009) briefly stated that the information systems are as communication systems that include people in producing, collecting, storing and spreading information.

As a result, there are various types of information system definitions and they change in terms of having perspectives. Consequently, information system can be defined that it is a versatile system that collects, processes, and stores the information by

taking organizational aims into consideration and the workers/organizations access the required information for organizational task by using it. Therefore, the system helps the workers and the organization to make better decision.

2.2. Usage of Information System in Organizations

Nowadays, information systems are widely used in many various organizations. Not only the for-profit (business) organizations but also non-profit organizations commonly use the information system. In other words, "There are many kinds of information systems and have been implemented in many sectors" (Warnars, 2010, p.135). For prevalence of using information system in organizations, Thong and Yap (1996) expressed that in organizations, computer-based information systems are becoming pervasiveness means that automates daily tasks and helps decision-making. Because organizations see information system as their power tool to complete their daily works, give the best service to their own organizations, or obtain the correct decision-making for their work process.

The purpose of any organization's information system is viewed as to develop the performance of people in the organization (Malik & Goyal, 2001). However, the reason of using information system cannot be constant because there are different reasons to use the information system and they change depend on the type of organization and aim of that. The objectives of information system alter right information –at the right time to act development. In each organization, the information system is created by taking aim of the organization into account to reach the desired goals. All of the information systems cannot be same each other and it is clear that "the architecture for information system will depend on each of organization, the organization's need" (Warnars, 2010, p.135). Therefore each of information system has their own specific character as their definitions in terms of different perspective.

2.2.1. Benefits of Information System

Information systems are commonly used in many organizations and the importance of its role has been increased by and by. Both the more usage of information system and increasing of its role are related to its benefits to the organizations. First of all, it provides the important and necessary information to the organizations. In this point, Saeidi and Marzban (2013) expressed,

> According to the increasing role of information in organizations and their needs to have these kinds of information in order to continue their activities, the importance of information system is manifested. Evaluating the role of this information in organizations and achieving a useful information system that can lead to organizations' progress and development is of importance (p.22).

Thanks to the information system, in organization the daily works or tasks can be done easily and fast. It includes the desired information and when there is a need for making a decision about the organizational works, information system helps this process by providing them with desired information. For success of an organization, management information systems play an essential part in the organization. As a result, these systems supply the internal-external or inter-organizational informational structure that are needed by the business owing to providing operational efficiency, providing an efficient management and a competition advantage (Edelhauser, 2012). In addition, Saarinen (1996) stated that information systems both change the organization's structure and develop work process, making effectively decision making processes and strengthen the controls of the organization.

Moreover usage of information system can affect the workers' performance positively. Because of reaching necessary information easily, they can complete the daily works or other organizational works early and fast than before. Another benefit of information system is that it aids to increase productivity by process effectively and supplying essential information to an organization and providing their efficient

work performance (Lee & Yu, 2012). According to Edelhauser (2012), information systems are mainly fundamentally means to provide the functionality for the businesses an important factor that affects operational efficiency, the employees' productivity and the customer relations; they are a principle of data that provide correctly decision-making, a method of improving new product and they are one of the most essential sources of organization. The effective information system influences the user behavior positively (Grover, Jeong, & Segars, 1996). In other words, it develops both user and organizational productivity, and the communication. Furthermore, the communication of among workers can increase by using information system. Although they are different departments of the organization, their communications become more comfortable and accessible. In addition, when taking outside the organization into consideration, the information system also provides better communication between the workers and the customers of organization. Saarinen (1996) emphasized that information systems frequently help to improve communication, not only inside the company but also between the company and itscustomers and suppliers.

2.3. Effectiveness of Information System

Hamilton and Chervany (1981) defined the effectiveness of information system as the degree to which the information system elementally enriches value about accomplishing organizational goals. The organizations reach the desired benefits of information system (IS) if the effectiveness of information system is paid attention. It is needed to assess the performance of an information system with applicable criteria to continue the developments (Lee & Yu, 2012). Moreover Malik and Goyal (2001) expressed that information system activities have to be made more simply and effectively in organizations to enable the organization handle uncertainties of the business area. This situation can be succeed only if the effectiveness of information system is monitored both completely and continuously.

In information system research, its effectiveness has been widely seen as the dependent variable (Yuthas & Young, 1998). According to Thong and Yap (1996), information system is considered as effective means when if they provide the organizational effectiveness. In addition, Malik and Goyal (2001) expressed that only if an information system can be effective when it benefits to the organization as a whole and not to only sub units of the organization. In this point, it can be emphasized that an effective information system is an "effective" if only it is effective in all of the units of the organization.

Measuring the effectiveness of information system is important to take advantage of information system' benefits. To measure the effectiveness, it is essential to identify the factors influencing the success of information system because the factors can be used to anticipate the success of an IS or to identify a mechanism for accomplishing the success of an IS (Lee & Yu, 2012). The factors and criteria are considered in terms of organizational structure. Malik and Goyal (2001) emphasized that if information system aids accomplishing the factors mattering the most to the organization as a whole, it can be called effective. Each organization can pay attention several different factors or criteria that are important to the each of them. Founding a success model for a specific information system is crucial to figure out the IS success mechanism , the several different types dimensions of IS performance and the factors and their causal relations in IS success (Lee & Yu, 2012). Moreover the factors and criteria that affect the effectiveness of the information system can change in terms of different views. Miller (1989) mentioned some factors influencing the information system effectiveness. He stated that changing value structures of the people included in the effectiveness evaluation, organizational levels, and stages in organizational growth can altered the effectiveness criteria of information system in a organization

In 2001, Malik and Goyal designed and tested a wide variety of IS evaluation models. The model was created mainly organizational factors. In their study, effectiveness of information system was measure by using their integrated approach

model (Figure 1) including information system product effectiveness evaluation model, information system process effectiveness evaluation model, information system environment effectiveness evaluation model. In their study, it was pointed that the proposed model offers a simple and flexible approach to assess information system effectiveness.

Figure 1. Integrated View of IS Effectiveness (Malik & Goyal, 2001)

The other better known model, DeLone and McLean's model of information systems success (2003), and the model (Figure 2) has been used by many researchers.

Figure 2. Information Systems Success Model (DeLone & McLean 2002, 2003)

In their model, DeLone and McLean (2003) identified six dimensions that are information quality, the system quality, service quality, user satisfaction, and usage. According to their model, *information quality* is one of the important factors of effectiveness and it focuses on the characteristics of information output. *System quality* focuses on technical system properties. In this point Alhendawi and Baharudin (2013) stated that the system quality is interested with the system' performance properties. Moreover, Lee and Yu (2012) expressed "System quality represents the quality of the information system processing itself, which includes software and data components. System quality also measures the extent to which the system is technically sound " (p.86). Moreover, DeLone and McLean defined that *service quality* focuses on the support provided by from information technology support provider and information system department to the system' users. For *user satisfaction*, DeLone and McLean (1992) stated that although there are different types assessment of information system effectiveness/success, one of the most widely used measure is "end-user IS satisfaction" . In *system usage* dimension Au, Ngai and Cheng (2002) expressed that system usage is comparatively easier in order to put into operation and it represents confidence degree of users have in the effectiveness of their information systems. The DeLone and McLean information system success model combines both organizational and socio-technical perspectives of an IS.

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In 2010, Floropoulos, Spathis, Halvatzis and Tsipouridou used DeLone and McLean information system success model to investigate the success of information system from the perspective of expert employees. As information system, Greek Taxation Information Sytem (TAXIS) was examined. To gather data from the six dimensions of the IS success model, questionnaire was used. Another research was done by Lee and Yu (2012), ASP-PMIS (Active Server Pages – Project Management Information System) was developed and its success was measured based on the well-known DeLone and McLean information system success model. The two new factors, 'impact of efficient construction management' and 'impact of effective construction management' were added to DeLone and McLean IS success model. In the study, a questionnaire instrument was conducted to measure the success of the information system.

However, using the DeLone and McLean information system success model as a whole may not be appropriate to all organizations. As mentioned before, each organization has its own important factors/criteria when measuring the success of information system. Similarly, Thong and Yap (1996) emphasized that effectiveness of information system is a complicated variable. In literature, organizational effectiveness advised that finding an accurately measure of information system effectiveness cannot be possible and the criteria that are taken into consideration can change among organizations.

Except the factors, criteria and model, Ozkan (2006) stated that "While defining or measuring the effectiveness of the information systems function has proven complicated, further effort on refining IS assessment is essential for the effective management and continuous improvement of both the IS function and the organization" (p. 7). Furthermore, Von Hellens (1997) mentioned the assessment types to be used in the measurement. He emphasized that it is necessary that both quantitative and qualitative assessment are needed for the evaluation of the information and software systems; in other words, both of the assessments are essential for the evaluation. Quantitative measurement provides means to do

comparison one item or situation with another. But this measurement needs the contribution of the qualitative means which ought not to be ignored when making judgment on the quality levels. In support of this view, user perceptions are paid attention when measuring the effectiveness of the information system. Yuthas and Young (1998) claimed that in measurement of IS effectiveness, the more widespread approach is substitute measures such as user perceptions and usage statistics. And he continued that the researchers who take using of both the user opinions and usage statistics in the evaluation of the system into account presumed that system satisfaction or frequent of using the system finally provide both giving better decison making and adding value to a firm.

2.4. Usability in Information System

In computer system, the usability is all factors increasing or making possible the reaching goal of user during using the system in a specific task, if the system is available in a set of interrelated tasks. (Ovaska, 1991). For a system or equipment, the definition of usability is made as "the capability in human functional terms to be used easily and effectively by the specified range of users, given specified training and used support, to fulfill the specified range of tasks, within the specified range of environmental scenarios" (Shackel, 2008, p.24). Moreover, according to Nielsen (1993), usability is defined by 5 quality components which are learnability, efficiency, memorability, errors and satisfaction. The components are explained as below:

> *Learnability:* The system should be easy to learn so that the user can rapidly start getting some work done with the system.

> *Efficiency:* The system should be efficient to use, so that once the user has learned the system, a high level of productivity is possible.

> *Memorability:* The system should be easy to remember, so that the casual user is able to return to the system after some period of not having used it, without having to learn everything all over again.

Errors: The system should have a low error rate, so that users make few errors during the use of the system, and so that if they do make errors they can easily recover from them. Further, catastrophic errors must not occur.

Satisfaction: The system should be pleasant to user, so that users are subjectively satisfied when using it; they like it. (p.26)

Moreover, according to Ovaska (1991), the factors influencing the usability are described only in the use context so the usability concept is difficult. Also the relationship among usability factors are important. In 1983, Bennett showed the usability relationship as Figure 3, this relationship is important when evaulating the usability of a computer system. The relationship includes task, user , system and also goal.
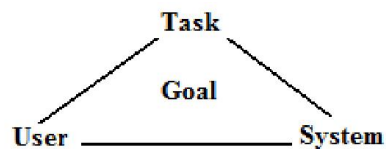
Figure 3. Usability Relationship (Bennett 1983)

According to Ovaska(1991), "It is not possible to evaluate the usability of a computer system without tying it up with the actual activities the user wants to use the system for" (p.47). Also he continued that if the user and the goal are not taken into account, the evaluation may focus on some details of the system that are not problematic for the user. In other words, the user should be involved in usability measurement and evaluation. Also tasks should be actual tasks that are done by users. Goodhue(1988) explained that the success of the system according to user evaluation based on Task/System fit would make a closer relationship with task performance and the researchers' criteria for evaluation the system by the user should focus on the Task/ System fit. The factors task, user and system are considerable when evaluating the usability of a system, also the goal is taken into consideration in the evaluation.

According to Macleod (1994), "Measurement of usability enables comparative testing against agreed criteria expressed in terms of levels of effectiveness, efficiency and satisfaction with which task goals are achieved, in context" (p.2). Measurement of usability in information system is also a common concept. Information systems are widely thought that it consists of two essential parts that are the user interface and the problem-solving engine. When looking usability engineering viewpoint, if both the usability concept with the user interface of IS and the usefulness concept with the complexity of problem solving are connected, "usability axiom" holds: IS have to be both usable and useful (Pantazi, Kushniruk, & Moehr, 2006). However, these concepts are different each other. According to Pantazi, Kushniruk, & Moehr (2006), unfortunately with existing information technology, both usability and usefulness concepts are dependent of each other as though their sum remains constant. Moreover they continued that " Highly usable systems are often less useful because they typically solve trivial problems. Conversely, potentially very useful systems that could solve complex, specific problems usually end up exhibiting usability problems" (p.830). Occasionally, it is proposed that just adding a graphical interface and supplying a choosing of widgets will 'solve usability' and usability is deeper issue than that. What many good designers might not completely realize is that designing for usability means supplying users to the interaction meeting the needs of the users to success their task goals in their work place. Even though this case is realized, designers and evaluators can lack for accessing to sufficient information about the characteristic of the users, tasks and environments. Thinking usability in terms of quality of use give a chance to evaluation that can inform design and redesign to give a possibility development for users in the work environment (Macleod, 1994). On the other hand, Pantazi, Kushniruk, and Moehr (2006) mentioned the usability paradox. They continued that the usability axiom is seen as a paradox. Because usable user interface requires be simple and useful. Information system can solve the difficult problems so it needs complex problem solving engine. Namely, information systems have to be both simple and complex. But the paradox would be removed only when the information system could be divided completely and their user interfaces and their problem-solving engines could be addressed

separately. If there are done, the simple and low complexity user interface can be built to systems overcoming complex problems.

To sum up, in usability test including user, task and system is interested not only user interface but also problem-solving engine. The usability can be used to measure the effectiveness/success of the information system in organizations.

2.4.1. Measuring Information System Usability

Information system use information and technologies to achieve successfully the tasks-business processes that help organizations to reach their objectives. Even though information usage is completely examined while systems development and these examining aid to design the most applicable system, there are still issues that influence the successful performance and effectiveness of the systems. They arise from changing and unpredictability of nature of the human component included (von Hellens, 1997). "Human component" is needed to measure the effectiveness of information system and for this requirement, there are many usability instruments needed to be filled by opinion of end-user who is "non-technical personnel who use or interact with the system directly, as opposed to technical personnel who design the IS." (Au, Ngai, & Cheng, 2002, p.453). The value of the "human factor" is emphasized by Wasserman (1991) and he stated that in companies employing human factors engineers in order to be interested to at least some user needs, in evaluation human factors findings might not be paid attention. However, the factor is critical to complete the effectiveness or successful of the system and to do this, the usability instrument is needed in usability testing.

In 1980's, it was realized that the fail of usability testing has frequently occurred, and it has been proposed that some laboratory studies have not had same conditions with actual system and the relation of the data to life was at most extraneous and at worst distorting (Whiteside, Bennett & Holzblatt,1988). Macleod (1994) stated that "Such testing employed inappropriate users – often viewed as 'subjects' in an 'experiment',

and perhaps chosen largely because of their availability – and assessed how subjects interacted with isolated parts of an information system, when instructed to perform a few low-level tasks in circumstances unrelated to actual work goals or the conditions of the workplace" (p.2). To obtain the accurate result, appropriate users and tasks are needed. User-based evaluation can study a subset of all the possible tasks that are supported a system but it should study tasks that are chosen in terms of their frequency or critically (Macleod, 1994). And the tasks are done by the users in the same conditions. That is to say, it is important to use same organizational context. As an organizational context, people and their work practices take part in information system and the effectiveness of IS is needed to assess in the same context by taking how well the everday information needs are met into account and this reflects the IS quality (von Hellens, 1997). Different conditions or different context may affect the user behaviour or their task performance.

When measuring the usability of a system, appropriate users, actual work/task/, actual system and same conditions are essential and to do this, the appropriate instruments are needed. However, "human component" is difficult to measure and the quality measurement is seen more subjective and it relies on both the culture and history of the organization. Therefore a lot of techniques are needed to judge the quality of the human component (Swanson, 1992). Thanks to the HCI (Human Computer Interaction), it is possible to obtain both the quantitative and the qualitative information from the user also it provides same conditions with actual system. In system development, it is commonly realized that there is a need of users involvement and in Human-Computer Interaction (HCI) field, user-centered design and development have long been made explicit (Norman &Draper, 1986).

The qualitative information plays a critical role in the usability of the information system. Von Hellens (1997) stated that a diversity of qualitative information is needed to be accumulated on the accurate performance of the systems and the perceptions of the users about it to provide successful organizational change and quality improvement programs. And in organizational context, this data is needed to

interpret the complexness of effects influencing information system quality. To give an answer for the system quality, it is needed the altered attitudes that people have about the system to figure out the multi-dimensional nature of information system in order that information system quality conceptualized successfully. Also to understand the altered underlying assumptions of the different dimensions (von Hellens, 1997).

Taking the literature into consideration, many studies include usability. Flavian, Guinaliu, & Gurrea (2005) analyzed the influence of perceived website usability on user trust and satisfaction. It was found that usability has a positive effect on user satisfaction. They emphasized that usability has a direct and positive relationship on the degree of user trust and satisfaction. Also they gave some recommendation by looking the result and they stated that "company strategies should be designed to achieve two basic objectives: a higher level of usability and a higher level of customer satisfaction. User satisfaction depends on the fulfilment of their expectations" (p.8). Also Oztekin, Nikov and Zaim (2009) researched on the UWIS (Usability of web-based information systems) assessment methodology. The usability of the student information system at Fatih University was measured. The three tasks were performed by the end-users in the computer laboratories of the university and the evaluation of the system with regard to UWIS checklist criteria was done by them. In the same year, P.N. & Dastidar (2009) studied on users' satisfaction level from an interface usability perspective. The variables are information content, format, ease of use, user support, consistency, design and ease navigation. Four significant factors influencing usability on user satisfaction was found. These factors are information content, format, consistency and ease of navigation. Also they emphasized that while designing a website, the designers should focus more on consistency and accuracy of the information. Another usability study was conducted by Belanche, Casalo, & Guinaliu (2012). The influence of website usability on both consumers' satisfaction and intention to use a website was investigated. It was found that website usability influences consumers' satisfaction and it affects intention to use. In the study, they also suggested that usability has a

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important impact on consumer behavior and it also influences the consumer intention to use a website indirectly through consumer satisfaction. Moreover, in 2013, Lin and Chen paid attention gender differences in their usability studies which is an automotive on-board navigation systems. System Usability Scale (SUS) was used in the study and they found that gender differences affect the system objective and subjective usability.

2.4.1.1. User Characteristics

When measuring the usability of information system, user characteristic also can be paid attention. It can generally affect the perception of usefulness of information system in terms of user perspective. Von Hellens (1997) emphasized the importance of user perspective on the system usage and expressed that to reduce the user perspective to the any simple quality feature of software is challenging, because the perspective is influenced by the users' experience that is about the system usage. Similarly, according to Macleod (1994), physical and organizational setting of the evaluation is not only the concern, the user characteristic and task are also concern. User characteristics are essential determinants of usability. Moreover, he continued that identifying the characteristics of the many kinds of user of an information system is a essential basis of usability context analysis. For evaluation of the information system' usability, users who are selected for usability study match the needed user characteristics.

On the other hand, Doll and Torkzadeh (1989) mentioned about using the system unwillingly, they stated that the users' reluctance to use the system and important alienation or end-users' dissatisfaction frequently changes technically successful systems into unsuccess. In other words, in a lot of organizations, there is a hidden or obvious unwillingness to participate to the development and implementation of information systems. In many organizations, there are user who are either covert or overt reluctance to participate to development or implementation of a new system (von Hellens, 1997). Moreover, Thong and Yap (1996) emphasized that there is a

complicated relationship between system usage and effectiveness of information system by taking the issue of voluntary versus mandatory use into account. When there is a voluntary use, system usage can be seen an applicable measurement for information system effectiveness so an objective measurement for information system effectiveness is provided. For measurement of usability/effectiveness of the system, preferring the users who are unwillingly use the system may affect the measurement negatively.

Moreover, Goodhue (1995) expressed that individual characteristics include a lot of possible constructs such as computer literacy. As an individual characteristic Computer Self-Efficacy (CSE) that is defined as a judgment of one's ability to use a computer (Compeau & Higgins, 1995). It is originated from Social Cognition literature and the definition of Selfefficacy is a person's belief in their ability to achieve a particular task (Bandura, 1997). Moreover, Mathieu, Martineau, and Tannenbaum (1993) defined Computer Self-Efficacy as a personal judgment of ability to use a computer. When measuring the usability of information system, computer literacy should be taken into account in terms of user perspective because (Strong, Dishaw, & Bandy, 2006) CSE is an essential focus of management information system and human computer interaction . Also the users' computer self-efficacy levels are paid attention when designing the interface.

In usability of information system literature, user characteristics were not taken into consideration too much. Goyal, Puroit and Bhaga (2011) studied on satisfaction and usability of the Internet on student's performance. They focused on relations among technology satisfaction of the users, their internet usage and technology resistance of them. Another study was done by Darejeh and Singh (2013), they studied on users with less computer literacy and they emphasized that the users need special software design. In this study, user characteristics were divided three categories that are elderly users, children and users with mental or physical disorders.

As mentioned above, user experiences, using the system voluntary or mandotory, computer literacy level are user characteristics. When measuring the usability of the

information system, the users characteristics are paid attention. This provides to measure the system from their perspectives. In this point, Wagner (2002) emphasized that if the interface is designed without taking the users' ability into account, the users are confused and this reasons many problems for them to develop conceptual model correctly. In other words, the users cannot figure out software structure and so they cannot work with the software completely.

2.4.1.2. User Satisfaction

Satisfaction is defined as the consumer's fulfillment response that is the judgment of a product or service and ensures an agreeable level of consumption-related fulfillment (Oliver & Swan, 1989). From an information system viewpoint, user satisfaction can be defined as the user's feelings towards to information system (Zmud & Boynton, 1991).

User satisfaction has been addressed in the information literature (Gluck, 1996). As a measure of information system effectiveness, user satisfaction that is one widespread perceptual measure, is researched for its appropriateness (Thong & Yap, 1996). In other words, both in management information system and information science literatures, the major system performance factor is user satisfaction and both of them use user satisfaction to judge the user's view of a system (Gluck, 1996).

Usage of some systems such as internet sites or information systems aimed at a general public may remain the most applicable and most simply assessed success measure; for information system, user satisfaction is more applicable (Gelderman, 1998). Because "The link between system usage and IS effectiveness is by no means simple, and perceptual measures, notably user satisfaction, have gained prominence as surrogate measures of IS effectiveness" (Thong & Yap, 1996, p.603). Moreover, Kassim, Jailani, Hairuddin, & Zamzuri (2012) stated,

User satisfaction has been used to surrogate information system success. It is an assessment made by a user, along a continuum from positive to negative, about certain qualities of information systems. Furthermore, various determinants of user satisfaction have been assessed and investigated on how users perceive their acceptance rate on the fit of the information system characteristics and user need (p.412).

According to Yen, Li and Niehoff (2008) the essential criteria in the evaluation of information system success is users' judgment . In other words, as a variable, user satisfaction is a crucial factor mediating information system quality and information system success (Lee & Yu, 2012).

However, Melone (1990) is in doubt that the users necessarily have attitudes toward their information system, if there is an attitude, whether they are formed when user satisfaction questions must be answered; it would influence the responses' reliability negatively. According to Thong & Yap(1996), user satisfaction problems are underlined and in this point the social psychology literature is employed to explain these problems. And he continued that "theories and models from the behavioural sciences offer a sound basis for understanding the problems with conceptualization and operationalization of user satisfaction" (p.601). There is a requirement to search the user satisfaction construct' root, and figure out its relation with the behaviour, to reach a net conceptuality of user satisfaction (Thong & Yap, 1996). Melone (1990) emphasized that for effectiveness of information system, user satisfaction cannot be a surrogate as satisfied users only are not indicative of an effective information system. A poorer reason for using user satisfaction considers that there is an strong correlation between information system effectiveness and user satisfaction. The people' attitude regarding an information system is more complicated that conceptualized, much may be got from a more theoretical comprehension of the user satisfaction concept. Information system attributes with high rating do not coerciblely cause user satisfaction that has high level. For this reason, the old models might not have reached the actual causes or explained the underlying reasons for end-user satisfaction or dissatisfaction (Au, Ngai, & Cheng, 2002). In this point, Cyert and March (1963) connected the user satisfactions with satisfied their needs.

They stated that if an information system supply the needs of the users, the users' satisfaction about the information system will rise. On the contrary, if the system does not ensure the required information, the users will get dissatisfied . Furthermore, user satisfaction measurement is criticized as an instrument. Saarinen (1996) expressed that the user satisfaction instrument has been commonly admitted although it is criticized for disregarding the important issues related to the information system' success. It gauges success just indirectly, by determining the information system' quality and services. Measurement of information system success also involves the development process and the effect of the information system on the organization. Additionally, Gelderman (1998) emphasized that user satisfaction is a criteria for information system success. User satisfaction may be measured with enough reliability, in general if the large version of the instruments is used .

Although there are some criticisms, mostly its pros is mentioned. Powers and Dickson (1973) asserted that the most essential criteria in measuring information system success and failure is user satisfaction. Also according to Seddon and Kiew (1994) user satisfaction can be the most "omnibus" measurement of IS success. One essential extent that ought to be involved in measurement of information system success is the its impact on end users (Au, Ngai, & Cheng, 2002). That is to say, one of the most commonly used part in the information system success model is user satisfaction that affects the information system' success and also it is an effect variable of information system quality (Lee & Yu, 2012). Computing components may be assessed by using normative techniques, whereas to assess customer satisfaction interpretive techniques and qualitative analyses give best insights to the status of quality. If information systems quality is to be improved, all levels of its usage need to be considered (von Hellens, 1997). Evans (1976) advised that user satisfaction is either a perceptual or subjective measure of information system effectiveness.   It can be an sufficient substitute for the information system effectiveness; in other words, if a "good" system is sensed by its users as a "poor" system, it is a poor system.   One of the important objectives of information system

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success is to satisfy the users. For supporting acceptance of user on usage of information system, it is significant to provide an applicable level of fit between the needs of user and expectations (Kassim, Jailani, Hairuddin, & Zamzuri, 2012).

Taking the literature into account, many studies focus on user satisfaction. Gluck (1996) studied on user satisfaction in organizations. He investigated the relationship between user satisfaction and relevance in information systems. In his study, user-based measure was used and to gather the data, sense-making questionnaire was conducted. It was found that there is an overlap between user satisfaction with retrieved items and relevance of those retrieved items. In similar manner, Yuthas and Yound (1998) included user satisfaction as Gluck did in their study. They examined the relationship between materials management information system performance, user satisfaction, and system usage. As instrument, a computerized inventory system was developed in the study. It was found that even though satisfaction and usage are closely associated with performance, the relationships among the measures are not sufficiently strong to provide their use as interchangeable measures of effectiveness. However, Gelderman (1998) found different results in user satisfaction point from Yuthas and Yound research. In Gelderman' study, for the success of information system, it was investigated the validity of two usually used measures that are usage and user satisfaction. As instrument, questionnaire was used and it was found that user satisfaction is significantly related to performance; however, the relation between usage and performance is not significant. A partial correlation for user satisfaction is not significant either.

Another research including user satisfaction was carried out by Au, Ngai and Cheng(2002). They also paid attention psychological processing of users. In their study, End-User Information System Satisfaction (EUISS) measurement was used to assess information system success and an integrated conceptual model based on the equity and needs theories was proposed. These theories were paid attention because of user' psychological processing of the information system. Based on the theories,

three additional comparison, "equitable work performance fulfillment", "equitable self-development" and "equitable relatedness fulfillment", are suggested for the measurement of EUISS. Goyal, Purohit, & Bhaga (2011) investigated satisfaction and usability of internet usage on students' assignment completion tasks and their performance. They found that there is a significant relationship between the internet usage and technology satisfaction.

Furthermore, Aggelidis and Chatzoglou (2012) focus on user satisfaction in their study. They built and empirically tested a new conceptual perspectives on how end-user computing satisfaction (EUCS) model(Figure4) of Doll and Torkzadeh (1988) for the hospital information systems. Unlike the general satisfaction measure, the Doll and Torkzadeh model includes 5 components: content, accuracy, format, ease of use, and timeliness. For study, the added constructs were 'the system processing speed', 'user interface', 'user documentation', 'user training', 'the support provided by the information department' and 'the support provided by the maintenance company'. In data collection, a questionnaire was used. Moreover, except user characteristics, their attitudes, needs, and social psychologies, Lin and Chien (2010) studied on the effects of gender differences on operational performance and satisfaction with car navigation systems. Questionnaire for User Interface Satisfaction (QUIS) was used and it was found that gender differences affect the system operational satisfaction.
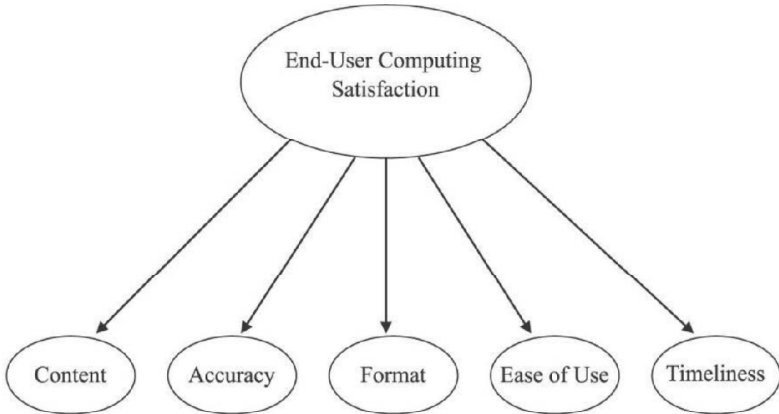
Figure 4. End-User Computing Satisfaction (EUCS) Instrument (Doll & Torkzadeh, 1988)

2.4.2. Human – Computer Interaction in Usability

The Human-Computer Interaction (HCI) provides communication between human and computer (Cui & Xue, 2009). It is, one of the most powerful computer science element, the compound both of computer science and cognitive science. In terms of computer science, its importance is to improve the interactive products for computer based system used to human with in effective manner (Zhu & Wang, 2006).

By management information system researchers, HCI is seen as the interaction not only between the human and computer but also among other elements like environmental matters and job features. Namely, human-computer interaction in management information system is interested in the human use of technologies to assist tasks within certain contexts (Zhang & Li, 2004). Moreover, Dillon (2006) compared management information system and human computer interaction. He stated that,

> Management information system can be considered to be primarily concerned with identifying, abstracting, and supporting the data flows that exist in organizations, and developing or supporting the technological (broadly conceived) means of exploiting the potential to serve organizational ends. Similarly, HCI seeks to maximize the use of information through the design of humanly acceptable representational and manipulator tools (p. 28)

For usage of information system as an effective, the design or interface of it is essential for both the users and the organization. Interface is collecting both of methods and techniques to create an interplay with something in the actual world and it lets the user to make communication with computer or vice versa and the using interface lets the user to enter required data via input devices and allows the computer to create an interplay with users via output device, screen (Koppu, Viswanatham, & J, 2012). In this point, Nielsen (1993) defined an usable interface as one that is: easy to learn, efficient to use, easy to remember, pleasant to use, and which causes few errors (Figure 5). The well-designed interface facilitates this communication. In this way, the users can use the system properly and fluently. This

may affect positively the other factors such as user satisfaction, organizational benefits, effectiveness of system, productivity of employees.
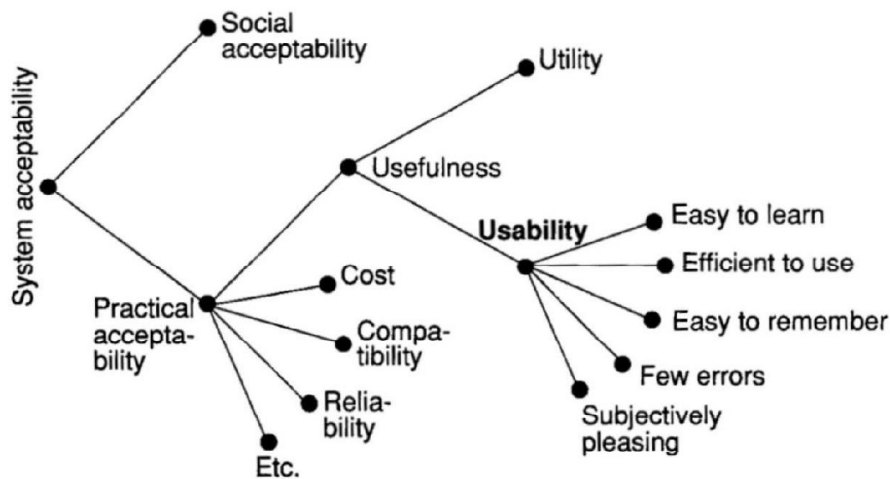
Figure 5. Nielsen's Taxonomy of the attributes of system acceptability (Nielsen, 1993)

According to P.N. & Dastidar (2009) user interface design, also known as Human Computer Interaction (HCI) has major significance as a good user interface design and it can impact the acceptance and rejection of a product. If end-users feel it is not easy to learn, not easy to use, there is a high chance for an excellent product to fail. Moreover, Nielsen and Norman (2000) emphasized importance of HCI in usability area. They pointed that Human Computer Interaction (HCI) design has a significant influence on the usability and user satisfaction level.

In 2005, Ferreira and Pithan investigated integrated concepts and techniques from the Human-Computer-Interaction (HCI) and Information Science (IS) areas, and they analyzed the usability of the InfoHab digital library. They stated that "it was possible to observe that the users' actions, feelings and thoughts, as well as their experiences disclose significant indications to learning components, memorization, errors, efficiency of the digital library and mainly users' satisfaction" (p.11). To measure the

interface of the system in terms of user perspective, HCI can be used because of being interact method. The user use the system in same context, not in different context so whether the interface is reasonable for the user or not can be arose. In HCI studies, eye-tracking has been used to measure the usability. After the measurement, it is possible to obtain the qualitative information.

2.4.2.1. Eye-Tracking Methodology in Usability

 "Eye tracking is a method to capture the movements of the eyeballs to infer where on a stimulus a person looked at, for how long, and in which order" (Gegenfurtner & Seppänen, 2013, p.395) and the eye-tracking is used in Human-Computer Interaction (HCI) field. In HCI, the basic tasks are as moving information between the user' brain and the computer (Jacob & Karn, 2003). "Most current user interfaces provide much more bandwidth from the computer to the user than in the opposite direction. The movements of a user's eyes can thus provide a convenient high bandwidth source of additional user input " (p.591). In usability test, using eye-tracking technique has revealed to be a valued supplement to traditional methods because it added a supplementary understanding regarding to design issue and user performance (Eghdam, Forsman, & Falken, 2011).

Moreover, although Rayner (1998) mentioned the cons of eye-tracking, he emphasized its pros. He expressed that although in eye tracking experiments, data have some generalization problems, they are precious as they supply detailed data in information processes and they will be used to examine cognitive processes. Furthermore, Schiessl, Duda, Thölke, and Fischer (2003) stated that eye tracking equipments make available additional value in settings of usability testing. "A combination of usability testing as a practical assessment of system effectiveness, efficiency and user satisfaction, and eye-tracking technology can provide additional understanding of design problems and user performance" (Eghdam, Forsman, & Falken, 2011, p.946). Moreover Jacob and Karn (2003) stated that "Using eye tracking in human-computer interaction both retrospectively, for usability

engineering and in real time, as a control medium within a human-computer dialogue" (p.597).

Taking the literature into consideration, many studies include eye tracking technology. Djamasbi, Siegel, Tullis, and Dai (2010) examined user behavior in relation to images in the area of a homepage located below the fold. Data was collected by using subjective ratings and objective measurements, including eye tracking. It was found that users find a page that has images of people's faces more appealing than a page that has no images of faces and perform tasks more quickly when there are faces present. Another study including eye tracking technology was conducted in 2011 by Eghdam, Forsman, Falkenhave, Lind and Koch. They studied to measure efficiency, effectiveness and used satisfaction of a prototype called Infobiotika which aims to support antibiotic use in intensive care. In their study, traditional usability testing was combined with eye-tracking technology. After participants performed three tasks, questionnaire was conducted to measure user satisfaction. They stated that " Applying eye-tracking technology during usability testing has shown to be a valuable complement to traditional methods that revealed many unexpected issues in terms of navigation and contributed a supplementary understanding about design problems and user performance" (p.945).

Moreover, Bergstrom, Olmsted-Hawala and Jans (2013) used eye-tracking in their usability study. They measured usabilities of five independent websites in terms of younger and older participants. After the measurement, they gave suggestions about the website design by taking into two different participants, younger and older, consideration. The other differences among users are genders. In the same year, Tonbuloğlu (2013) used eye-tracking method to test gender effects in usability test of educational softwares. He gave design recommendation in terms of gender differences and it was emphasized that interface can be designed based on the differences in eye-tracking results of different genders.

2.4.2.1.1. Think-Aloud Method in Eye-Tracking Methodology

"Thinking-aloud is a method to capture thought processes without changing their order or content by asking participants to utter their inner speech" (Gegenfurtner & Seppänen, 2013, p.395). Think aloud method is conducted two different ways which are concurrent think-aloud (CTA) and retrospective think-aloud (RTA). In CTA, the participants verbalize their thoughts while they are performing the task(s) in usability research. In RTA, the participants verbalize their thoughts after each task or all of the tasks are completed. In this point, van Someren, Barnard, and Sandberg (1994) stated that in think- aloud method, participants utter their thoughts while they are completing the task. In this way, the method helps researchers to get at the cognitive processes that underlie a specific action and provide interpretation of the questionnaire items by the respondent (McCorry, Scullion, McMurray, Houghton, & Dempster, 2013).

The theoretical framework for think-aloud protocol is provided by Ericsson and Simon (1984,1993). According to the model, different memory stores keep the information and in these stores, access and storage capabilities are changed. Namely, accessing easily and limited capacity to store the information are seen in short-term memory; in contrast, accessing more difficult and larger storage space are features of long-term memory. The information in short-term memory can be accessed and reported directly that is static and conscious cognitive process. Therefore, information, not currently being paid attention, cannot be reported; however, it has to be made inference by verbalisations.

Moreover, Long-term working memory theory (Ericsson & Kintsch, 1995) concentrates on qualitative changes in memory structures. According to this theory, it is assumed that expertise is related to the information processing capacities through acquisition of retrieval structures letting experts to quickly encode information in long-term memory and efficiently get at it for later task operations. In this point, Gegenfurtner and Seppänen (2013) continued that if advanced learners make encoding and retrieve information more qucikly in familiar the rapid information

process ought to be reflected in eye movement and think aloud data, particularly smaller verbalizations and higher verbalizations integrate on information with prior knowledge . Ericsson and Simon (1980) stated that thanks to the think-aloud method, organizing information and integrating information with prior knowledge can be examined. For verbalization, essential cognitive psychological studies were done by Nisbett and Wilson (1977) and Ericsson and Simon (1993) on the both reliability and validity of verbalizations in relation to mental processes. Later, Boren and Ramey (2000) examined how there is a difference between think-aloud method in usability testing and think-aloud method in cognitive psychology and proposed Speech Communication theory as an alternative theoretical framework. Think-aloud method is frequently used for the evaluation of website usability. There is a large amount research on the collection of think-aloud methods (Elling, Lentz, & De Jong, 2012). Taking the literature into consideration, many studies include thinking-aloud method. In 2005, Cooke and Cuddihy investigated the usability of a website (Washington State Department of Licensing) by using think-aloud protocol in their eye-tracking study. In their study, the participants were instructed to think aloud while they were performing the tasks. They emphasized that think-aloud protocol provided veridical insights into participants' thought processes while they were performing website tasks. Another study including think-aloud method was conducted by Mcdonald, Edwards and Zhao in 2012. They explored two different think-aloud methods (CTA and RTA) usage in usability test. An qualitative survey was conducted using a web-based questionnaire and participants found that CTA is suitable for usability test because it is fast, easy for users to related to, and requires limited resources. A usability study including CTA was conducted by Elling, Lentz and De Jong (2012). In the study, 60 participants with different characteristics performed tasks on websites. While the participants were performing the tasks, they verbalized their thoughts and their eye movements were recorded simultaneously. They suggested that future reserach should focus on influence of characteristics of the participants who are involved in the study.

In addition, in literature except the usability studies including think-aloud method,

there are think-aloud studies   was conducted in medical fields.   In 2013, Gegenfurtner and Seppänen tested   whether expert performance and its underlying processes transfer to novel tasks within a domain. The study was conducted in medical area that is radiology and nuclear medicine. A mixed method study using eye-tracking and quantitative and qualitative analyses of think aloud protocols was conducted. In the study, computer-based images displaying identical patient cases were used.   Another medical study including think-aloud method was conducted by Kaklamanou, Armitage and Jones (2013). In the study, fourty-three participants completed the compensatory health beliefs questionnaire while thinking aloud. Furthermore, McCorry, Scullion, McMurray, Houghton, and Dempster (2013) used think-aloud method in their medical study. The participants were the adults with type 2 diabetes and they were asked to complete the Illness Perceptions Questionnaire – Revised (IPQ-R) using a 'think-aloud' methodology.

CHAPTER 3

METHODOLOGY

This chapter starts with design of the study, participant and sampling, instruments, the FDP Information Portal, validity and reliability, and data analysis are provided. The study addresses the following four questions:

1. What are the FDP students satisfaction levels about the FDP Information Portal in terms of their gender and institute types which are GSSS (Graduate School of Social Sciences) and GSNAS (Graduate School of Natural and Applied Sciences) ?

    1.1. What are the negative and the positive aspects of the FDP Information Portal according to the FDP students?

2. What is the FDP Information Portal' Usefulness Score in terms of FDP students' genders and institute types which are GSSS and GSNAS?

3. Is there a relationship between the FDP Information Portal' Usefulness Score and the FDP Students Satisfaction Levels?

4. What are the usability problems of the FDP Information Portal according to the FDP students when they perform the four main tasks (creating a project request, finding the "Proje Onay Süreci" graph, creating an academic travel request and finding the "Yurtiçi ve Yurtdışı Görevlendirme Yönergesi" document) on the portal?

    4.1   What are the usability suggestions of FDP students about FDP Information Portal after the usability test ?

3.1. Design of the Study

Mixed-method research design guided data collection and analysis for this study. Mixed-method research involves the use of both quantitative and qualitative methods in a single study (Fraenkel, Wallen, & Hyun, 2012). Mixed-Method is appropriate for this study, which aimed not only to investigate the usefulness score of the FDP Information Portal and the user satisfaction score in terms of the Portal but also to explore the usability and satisfaction problems with qualitative data. Collecting qualitative data provided better understand and interpret the quantitative data.

Also as strategy, the Sequential Explanatory Design Strategy (Figure 6) which is typically used to explain and interpret quantitative results by collecting and analyzing follow-up qualitative data (Morse, 1991) was used in the study. This design explains and interprets "quantitative results by collecting and analyzing follow-up qualitative data" (Creswell, 2003, p.211). The first three research questions and their sub-questions are addressed in the quantitative portion and the fourth research question is addressed in the qualitative portion of this study. Quantitative data are gathered to answer quantitative research questions; qualitative data helped supplement and explain the quantitative findings.
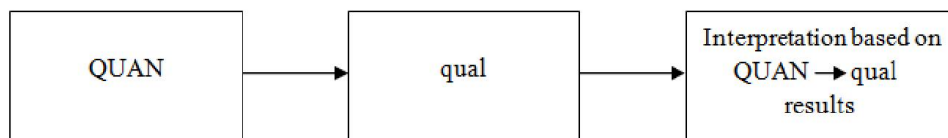
Figure 6. Explanatory Design (Creswell & Clark, 2006)

In other words, this research uses both quantitative and qualitative components to investigate the usability issues of Faculty Development Program (FDP) Information Portal. The first three questions and their sub-questions derive quantitative data is derived from FDP students; the fourth question derives qualitative data from eye-tracking (the users' gaze plot and their voice record) and interview (after the eye-tracking methodology) with the same sample.

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The questionnaires that are Computer Literacy Scale, System Usability Scale (SUS) and Questionnaire for User Interface Satisfaction (QUIS) were analyzed first. Next, as usability test, Concurrent Think-Aloud (CTA) method in Eye-tracking methodology was conducted, after the usability test an interview was used to collect in-depth responses to supplement the results of the CTA and questionnaires.

3.2. Participants and Sampling

The research is based on a population of 270 FDP students at METU in Turkey. The research was informed to the all FDP students via email and asked them to fill the questionnaires including Demographic information (Gender, Institute Type, frequency of their computer usage, their computer literacies), System Usability Scale (SUS), Questionnaire for User Interface Satisfaction (QUIS) from an online survey website. The 100 FDP students which is about 37% of the population filled the questionnaire from an online survey website.

In qualitative research, due to rigors of the weather in December and being away from HCI laboratory to the campus center, the 20 FDP students whose departments are near to the laboratory were selected randomly and e-mail was sent to ask them to participate the Usability Test (Eye-Tracking) which is done in Human-Computer Interaction (HCI) laboratory in Computer Education and Instructional Technology (CEIT) department at METU. The Usability test was conducted with five FDP students. Two of them were females and remaining were males. Also a female and a male are registered in GSSS as FDP students, and remaining are registered in GSNAS as FDP students.

According to Nielsen' usability graph (Figure 7) which explains the number of usability problems found in a usability test with n users, only one user provides to be found about 25% of usability problems, while fifteen users make it possible to find 100% of the problems. In this study, it is expected to find between 75% and 100% usability problems of the FDP Information Portal.
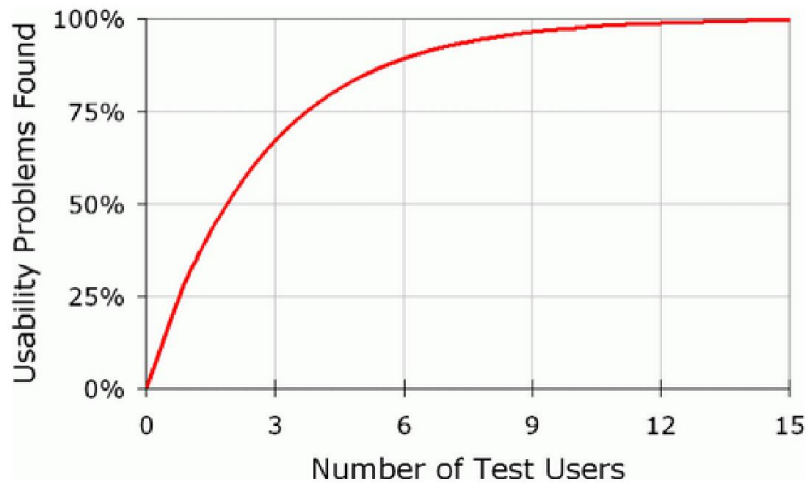
Figure 7*.* The number of usability problems found in a usability test with n users
(NIELSEN, 2000a, p.1)

The population is 270 FDP students at METU; however, 100 FDP students participated to the study. Among the samples, 57% are females and the remaining are males. The samples' demographic information (gender, institute type, frequency of computer usage) are presented in below. Table 1 and Figure 8 shows distribution of gender in terms of the institute types.

Table 1. Gender Distribution in terms of Institute Types

Institute Type	Female	Male	Total
GSSS	30	22	52
GSNAS	27	21	48
Total	57	43	100

Note. GSSS : Graduate School of Social Sciences, GSNAS: Graduate School for Natural and Applied Sciences

In GSSS, there are 30 females and 22 male students. On the other hands, in GSNAS there are 27 females and 21 male students. In Figure 8, it is clear that both institutes have more female students than males.
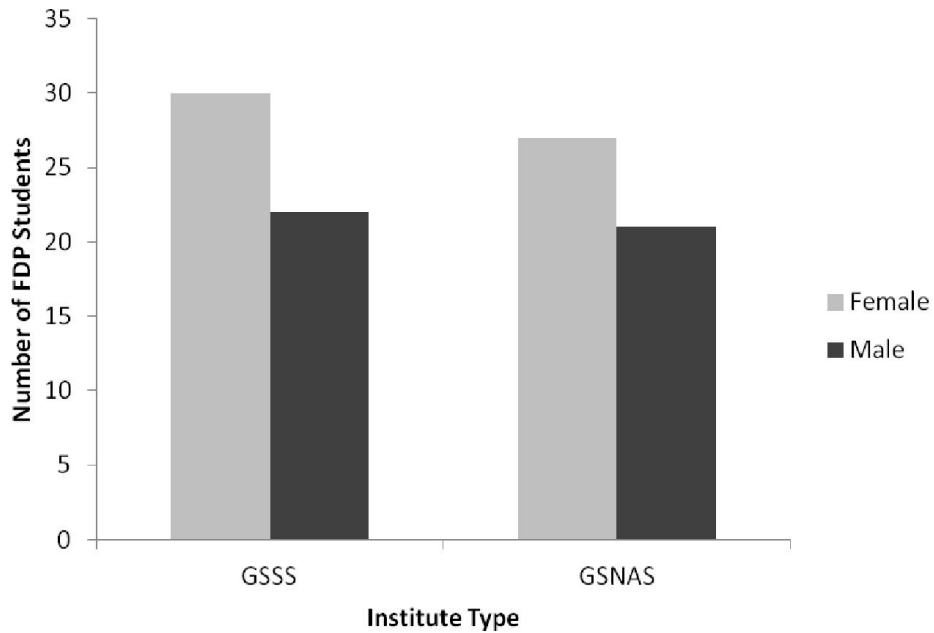
Figure 8. Gender Distribution in terms of Institute Type

In the study, FDP students' computer usage hour within a day, computer usage years and perceived computer competency levels were collected as descriptive data. Table 2 presents both the means of the computer usage hours within a day in terms of female (M=6.61) and male (M=7.19), and the means of the computer usage years terms of female (M=13.47) and male (M=15.00).

Table 2. Computer Usage Statistics in terms of Gender

	Female		Male	
	M	SD	M	SD
Hour	6.61	3.39	7.19	2.85
Year	13.47	3.00	15.00	3.46

Note. Hour: Computer usage hour within a day, Year: Computer usage years

In Table 2, it is clear that male students spend more hours for computer usage than females and also they have been using the computer more years than females have. Moreover, Table 3 presents these variables in terms of institute types.

Table 3. Computer Usage Statistics in terms of Institute Type

	GSSS			GSNAS	
	M	SD		M	SD
Hour	6.85	3.14		6.88	3.23
Year	14.04	3.38		14.23	3.20

Note. Hour: Computer usage hour within a day, Year: Computer usage years, GSSS: Graduate School of Social Sciences, GSNAS: Graduate School for Natural and Applied Sciences

In Table 4 presents both the means of the computer usage hours within a day in terms of institute types which are GSSS (M=6.85) and GSNAS (M=6.88), and the means of computer usage years in terms of institute types that are GSSS (M=14.04) and GSNAS (M=14.23).

Another descriptive data is the FDP students' perceived computer competency level. To measure the level, a Computer Literacy Scale that consists of 20 rating scales with a 5-point scale (1=*poor*, 5=*excellent*) was developed. Each item contains basic operations of computer. Table 4 presents the means both 20 items of the scale and total computer literacy scale in terms of genders.

Table 4. Perceived Computer Competency Levels in terms of Gender

	Female		Male		Total	
	M	SD	M	SD	M	SD
Total	4.64	.40	4.68	.28	4.65	.35

Note. Values are means scores on a 5-point scale (1=poor, 5=excellent), Computer Literacy Scale (20 items) ; N=100.

The total means are presented in terms of female (M=4.64) and male (M=4.68). Moreover the table presents the total mean (M=4.65) including both gender. Figure 9 presents the total means of perceived computer level in terms of gender. The means were calculated over 5.00.
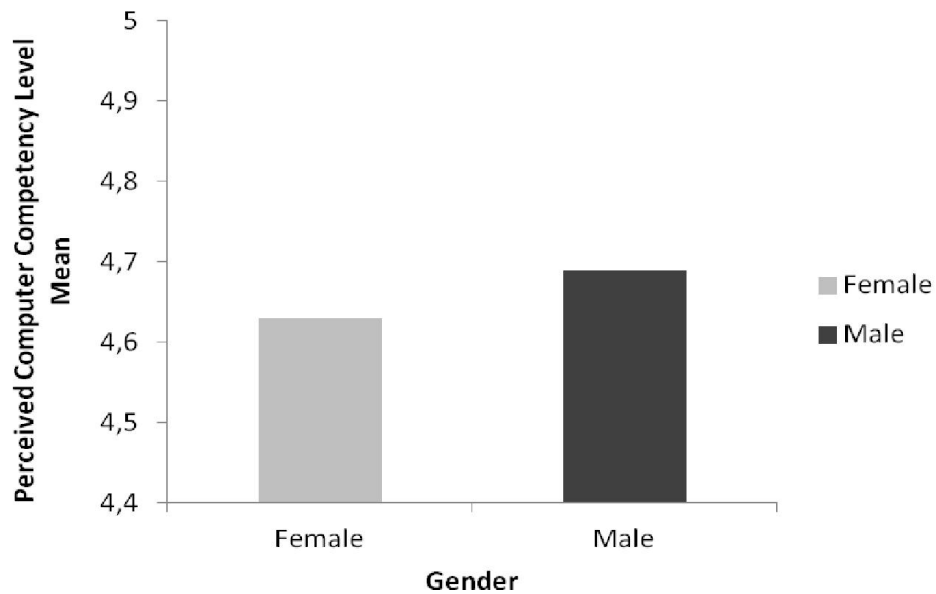
Figure 9. Perceived Computer Competency Level Mean in terms of Gender

Furthermore, Table 5 presents the perceived computer competency level in terms of institute types that are GSSS (M=4.60) and GSNAS (M=4.71). Moreover the table presents the total mean (M=4.65) including both institutes. Also, Figure 10 presents the total means of perceived computer competency level in terms of institute types. The total means of GSNAS is higher than the total means of GSSS.

Table 5. Perceived Computer Competency Level in terms of Institute Type

	GSSS		GSNAS		Total	
	M	SD	M	SD	M	SD
Total	4.60	.36	4.71	.33	4.65	.35

Note. Values are means scores on a 5-point scale (1=*poor*, 5=*excellent*), Computer Literacy Scale (20 items) ; N=100. GSSS : Graduate School of Social Sciences, GSNAS: Graduate School for Natural and Applied Sciences
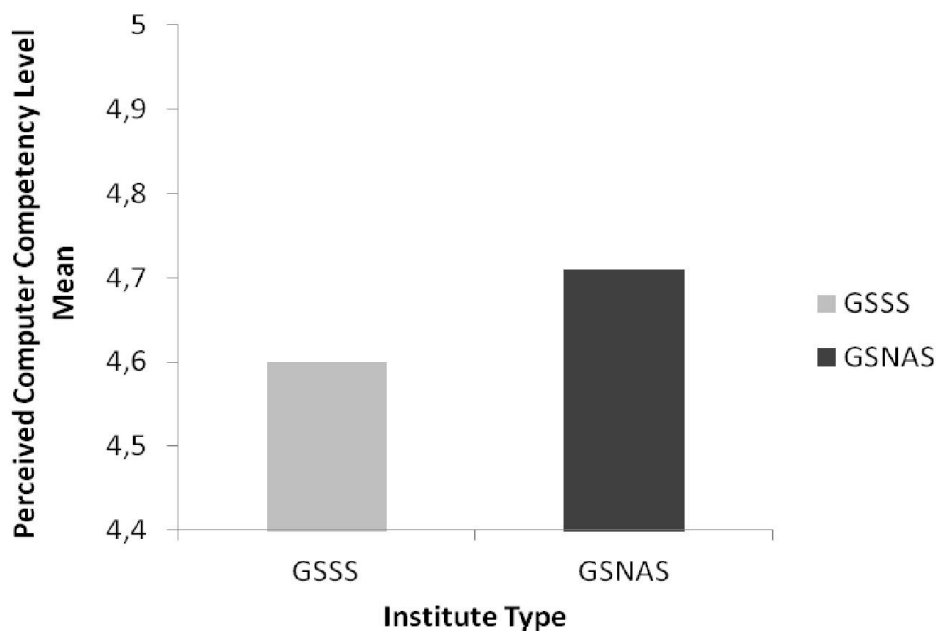
Figure 10. Perceived Computer Competency Level Mean in terms of Institute Type

3.3. Instruments

During the study, three types of instruments were used. These are questionnaire, eye-tracking, and interview. The following part gives detailed information about the instruments.

Questionnaire. The research is based on a population of 270 FDP students at METU. The research was informed to the all FDP students by sending them bulk mail from FDP-group and asked them to fill the questionnaires including Computer Literacy

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Scale, System Usability Scale (SUS), Questionnaire for User Interface Satisfaction (QUIS) from an online survey website. Because of limited participation to the study, personal emails were sent to each FDP student and asked them to fill the questionnaire from an online survey website. The 100 FDP students which is 37% of population filled the questionnaire from the website between August 2013 and November 2013.

The questionnaire including Demographic Information (See Appendix A), Computer Literacy Scale (See Appendix A) , Questionnaire for User Interface Satisfaction (QUIS) 5.0 version (See Appendix B), System Usability Scale (SUS)(See Appendix C) was used. Demographic Information includes gender, age, institute type, computer usage hour within a day, computer usage years and computer literacy levels. Computer Literacy Scale was developed for this study. It consists of 20 rating with a 5 Likert scale from 1("Poor") to 5("Excellent"). Each item contains basic operations of computer. Moreover, QUIS was developed by a team in the Human–Computer Interaction Laboratory (HCIL) at the University of Maryland (Chin, Diehl, & Norman, 1988). QUIS consists of 27 rating scales with a 10 point scale from 0 to 9 Likert scale and two pencils that are the most negative(s)/positive(s) aspects of the system. The 27 rating scales are divided into five categories: Overall Reaction, Screen, Terminology /System Information, Learning, and System Capabilities. Each category has polar opposites with no statements (e.g., Terrible / Wonderful, Difficult/Easy). Furthermore, SUS was developed by John Brooke in 1986 for assessments of usability and it consists of 10 item questionnaire with scale from 1("Strongly disagree") to 5("Strongly agree") Likert scale. The odd-numbered items worded positively and even-numbered items worded negatively. Each item's score range from 0 to 4. For positively-worded items (1,3,5,7,and 9) the score contribution is the scale position minus 1. For negatively-worded items (2,4,6,8 and 10), it is 5 minus the scale position. To obtain the overall SUS score, multiply the sum of the item score contributions by 2.5. Thus, SUS scores range from 0 to 100 in 2.5-point increments.

Eye Tracking. After the questionnaire, eye –tracking methodology was conducted on December in Human Computer Interaction (HCI) Laboratory at CEIT. Before obtaining actual data, a pilot study was conducted two FDP students who are registered in CEIT that is a department of GSNAS and in order to identify the problems that might be occurred in actual study. After they came to the HCI Laboratory, they were informed about research, usage of eye-tracking and CTA method. Moreover, they reviewed and signed the voluntary participation form that explains the aim of the research and how the eye-tracking data will be used in the study. Before the usability test, the four basic tasks (Appendix D) that will be performed in FDP Information Portal were given to them and they read it but they were not allowed to ask any questions about how the tasks are performed; however, it was stated that they can finish the usability test whenever they want also it was wanted them to think aloud when they perform the tasks because their voice records are supplementary data for the CTA method . When they feel themselves ready, the TOBII studio software was started for usability test. They thought aloud, verbalized their thoughts, feelings etc. and they talked nobody. After they finished the tasks, interview was conducted.

After the pilot usability test, the difficulties encountered were determined. The first one is the subjects did not keep their eyes on the screen, they wanted to ask questions about the tasks. The second one is, the fixations were not recorded of the subjects who use glasses. For actual usability test, information mail was sent to FDP students and asked them to join the usability test. Before the usability test, these two conditions were explained the subjects and it was wanted them to keep their eyes on the screen and not ask any questions and remove their glasses if they use. The other procedures that were applied in pilot study were applied all participants in actual usability test.

In Eye Tracking section, a desktop computer with Tobii Studio software, an external microphone to record voices, rules and task ocuments were used. The task document including four main tasks (See Appendix D) was given to the subjects.

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Interview. After the eye-tracking, the semi-structured interview was conducted in a face to face manner and audio recorded. The interviews (Appendix E) included both four questions about the tasks that were done in eye tracking and five general questions about the FDP Information System. The aim of the first four questions was identify the participant' perception about the performance and difficulties, strong and weak points of the system. Before the voice records of the participants, permission was got from them for interview. Each participant spent approximately 10 minutes to complete the interview.

3.3.1. Faculty Development Program (FDP) Information Portal

The FDP Information Portal is used by the FDP students, their advisors, the department chairs, the institutes and FDP officers. Each user logs in to the portal same way by using their username and password; however, according to the type of user account the interface and the content of the portal can change. The Figure 11 shows the main page of the FDP information portal (http://oyp.metu.edu.tr).
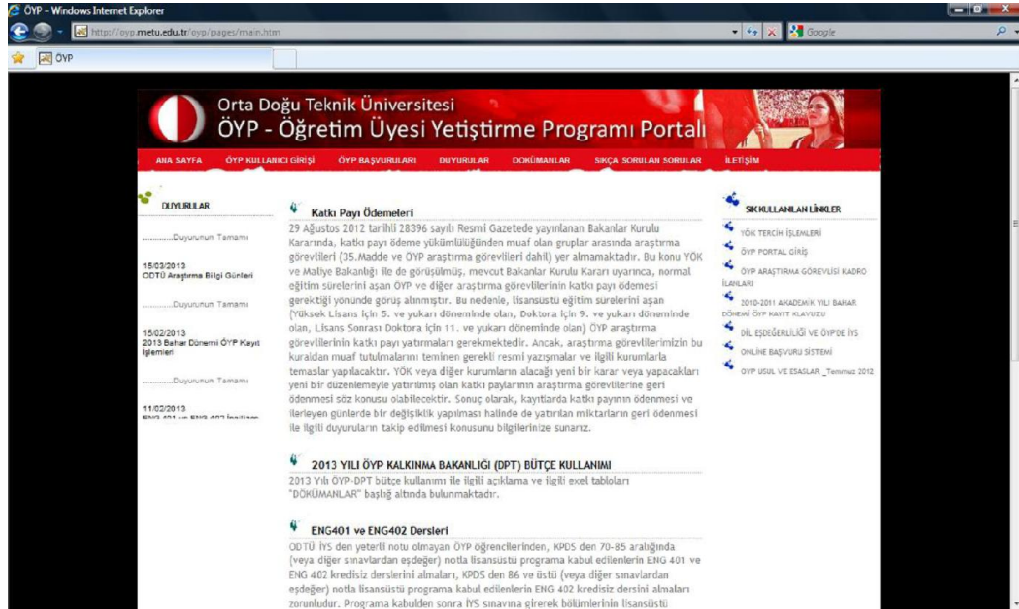
Figure 11. The main page of the FDP Information Portal

After clicking on the "ÖYP Kullanıcı Giriş" option, the users write their usernames and passwords to enter the FDP Information Portal (Figure 12).
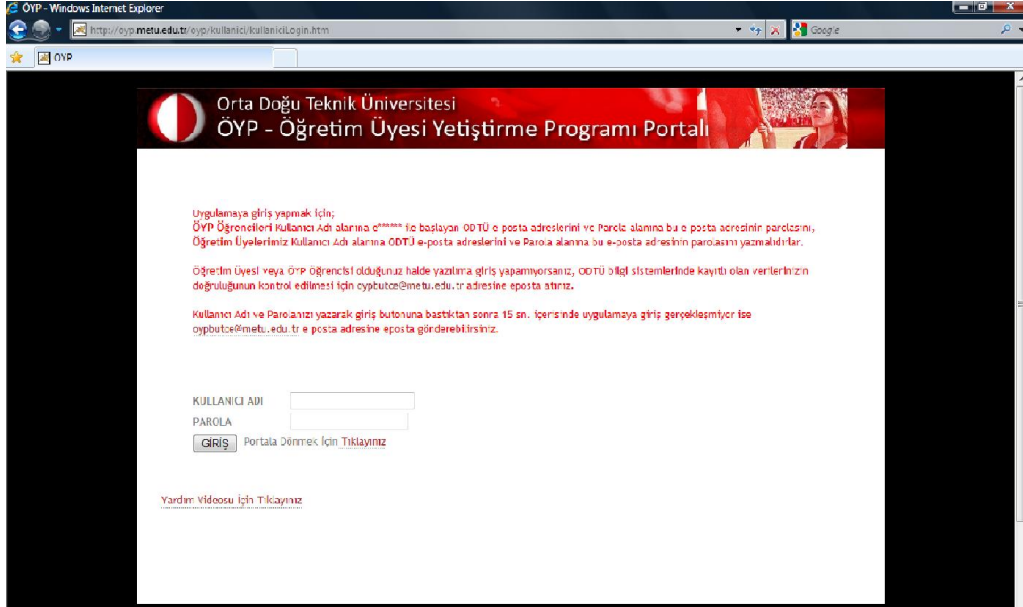
Figure 12. The login page of the FDP information portal

3.3.2. Validity and Reliability

Questionnaire. In this study, questionnaire including Computer Literacy Scale, Questionnaire for User Interface Satisfaction (QUIS) 5.0 version and System Usability Scale (SUS) was conducted. Computer Literacy Scale was created for the study and for content validity three experts ' judgments were took.   The second questionnaire is QUIS. According to Chin, Diehl and Norman (1988), reliability of QUIS is high. Version 5.0 has a reliability an Cronbach's alpha with .89. However establishing validity of the questionnaire is difficult because there is lack of theoretical constructs about interfaces to test the QUIS and there few if any other established questionnaires to cross validate the findings of the QUIS. The other scale is SUS and Brooke (1986) described "the selected statements actually cover a variety of aspects of system usability, such as the need for support, training, and

complexity, and thus have a high level of face validity for measuring usability of a system" (p.3). Sauro (2011) states that "SUS actually has two factors – Usability (8 items) and Learnability (2 items) and they have reasonable reliability (coefficient alpha of .91 and .70, respectively)" (p.1).

However, in this study, the reliabilities of both QUIS and SUS were re-tested with Statistical Package for Social Sciences (SPSS 18.0). Because of limited sample size, 100 METU undergraduate students filled the QUIS and SUS for METU-Online website (https://online.metu.edu.tr/) that is used by METU students. The result of QUIS reliability analysis is shown Table 6.

Table 6. The Reliability Statistics of Questionnaire for User Interface Satisfaction (QUIS)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.88	.92	27

Note. QUIS consists of 27 rating scales with a 10 point scale from 0 to 9 Likert scale. N=100

The reliability analysis was calculated in SPSS 18.0. The reliability of QUIS is high with Cronbach's alpha which is about .88. The result of SUS reliability analysis is shown Table 7. The reliability of SUS is high with Cronbach's alpha which is about .84

Table 7. The Reliability Statistics of System Usability Scale (SUS)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.84	.83	10

Note. SUS consists of 10 item questionnaire with scale from 1("Strongly disagree") to 5("Strongly agree") Likert scale.

Interview. For content validity, trustworthiness and understanding were taken into consideration and the experts opinions were followed. Semi-structured interviews have an average validity coefficient of around .5, whereas those with little structure have coefficients of around .2 (Salgado, 1999). For reliability, the same question in different type was asked in the same interview schedule.

3.4. Data Analysis

In this study, both quantitative and qualitative data were obtained. Data analysis was explained respectively in below:

Questionnaire. The obtained data was imported to SPSS 18.0. Each of the questions was measured in different ways.

For the first and second questions, the independent sample t-test were applied with 95% confidence level. Also descriptive analysis including mean and standard deviation was calculated for two question and the bar graphs were used to present the calculations. The data of the first sub-question including the negative and the positive aspects of the FDP Information Portal were obtained QUIS. First of all, the answers were read and the some keywords were highlighted. After reread the keywords or phrase, these were grouped. Finally, a code was given to the each group and the frequencies of the keywords or phrase in each group were calculated and frequency table was created.

For third question, to calculate the relationships between two dependent variables that are user satisfaction level and system usability score, Pearson Product Moment Correlations was used with 95% confidence level.

Eye-Tracking. First of all, as shown in Figure 13, the interface of FDP Information Portal was divided four parts; content area, left frame, menu area and banner area.
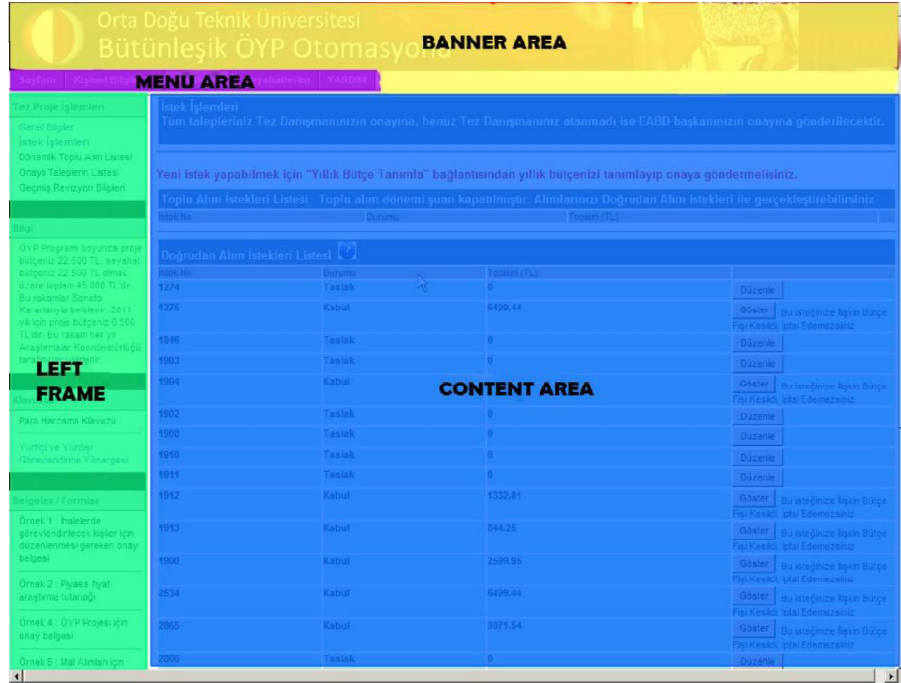
Figure 13. The areas of interest of the FDP Information Portal

Later, the record of each subject was divided into four scenes and each scene includes a task. In terms of four parts of FDP Portal, for each task , total fixation duration and fixation count were analyzed as quantitative data by using statistics part of Tobii Studio Software, also for each task, gaze plot and heat map were created as qualitative data by using visualizations part of Tobii Studio software.

Interview. Coding was used to analyze the interview data.After read twice the all answers of each subject. In initial coding that is the first stage in classifying, numerous codes were generated. By taking the codes into account, a diagram that shows the relationships among the codes was drawn. Secondly, in focused coding stage, some codes including repeated ideas were combined under the name of some meaningful phrases. Each phrase has its own codes and the frequencies of the codes. Moreover, the suggestions table were created by taking the meaningful phrases, codes and their frequencies.

CHAPTER 4

RESULTS

This chapter includes the results of the research questions. It starts with the FDP Students Satisfaction Level about the FDP Information Portal, the negative and the positive aspects of the FDP Information Portal, the FDP Information Portal' usefulness score in terms of FDP students' gender and institute types, the relationship between FDP Information Portal' usefulness scores and the FDP students satisfaction levels, the usability problems of the FDP Information Portal according to the FDP students when they perform the four main tasks on the portal, and the chapter ends with the usability suggestions of FDP students about FDP Information Portal.

4.1. The FDP Students' Satisfaction Level about the FDP Information Portal

To measure the user satisfaction level, Questionnaire for User Interface Satisfaction (QUIS) was conducted. This questionnaire consists of 27 rating scales with a 10 point from 0 to 9 Likert scale and two pencils that are the most negative(s)/ positive(s) aspects of the system. The 27 rating scales are divided into five categories: Overall Reaction, Screen, Terminology /System Information, Learning, and System Capabilities. Each category has polar opposites with no statements (e.g., Terrible / Wonderful, Difficult/Easy). The satisfaction level was measured in terms of both the students' genders and their institute types. Table 8 and Figure 14 represent five satisfaction means and total satisfaction mean in terms of gender.

The mean results of the female FDP students are as: Overall Reaction to the System (M=4.67), Screen (M=5.11), Terminology and System Information (M=5.04), Learning (M=4.94), and System Capabilities (M=4.80). In terms of the results, the highest mean is Screen (M=5.11), whereas the lowest mean is Overall Reaction to the System (M=4.67).

The mean results of the male FDP students are as: Overall Reaction to the System (M=4.91), Screen (M=5.60), Terminology and System Information (M=5.48), Learning (M=5.21), and System Capabilities (M=5.56). In terms of the results, similarly the highest mean is Screen (M=5.60), and the lowest mean is Overall Reaction to the System (M=4.91). Moreover, the total satisfaction mean of males (M=5.33) are higher than the females (M=4.91).

Table 8. User Satisfaction Means in terms of Gender

Categories/Items	Female		Male		Total	
	M	SD	M	SD	M	SD
Overall Reaction to the System	4.67	1.83	4.91	1.99	4.78	1.90
Screen	5.11	1.91	5.60	1.89	5.33	1.91
Terminology and System Information	5.04	1.88	5.48	2.12	5.23	1.99
Learning	4.94	2.14	5.21	2.34	5.06	2.18
System Capabilities	4.80	2.06	5.56	1.96	5.13	2.05
Total	4.91	1.74	5.33	1.82	5.09	1.78

N=100
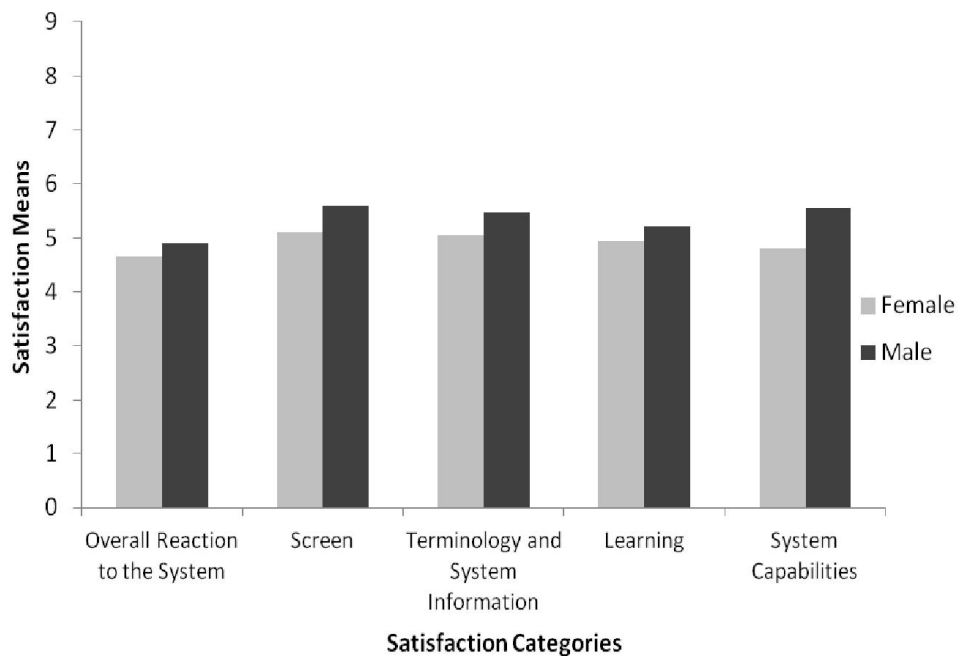
Figure 14. User Satisfaction Means in terms of Gender

In Figure 14, it is clear that the means of males in the five categories are higher than mean of each category belonging to female students. However to figure out whether there is a significant mean difference between the male and female FDP students' satisfaction means or not, independent samples t-test was conducted with 95% level of confidence. However, before presenting the findings of the independent samples t-test, the needed assumptions were checked (Appendix H).

Table 9. Independent Samples t-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Satisfaction Total	Equal variances assumed	.47	.49	-1.15	98	.26	-.41	.36
	Equal variances not assumed			-1.14	88.45	.26	-.41	.36

N=100

In terms of Table 9, there is no significant mean difference between the males' satisfaction means (M=5.33) and females' satisfaction means (M=4.91); $t(98)$= -1.15, p=0.26

Moreover , the satisfaction means were measured in terms of institute types. Table 10 and Figure 15 represent five satisfaction means and total satisfaction mean in terms of institute types which are GSSS and GSNAS. The results of the students who are registered in GSSS are as: Overall Reaction to the System (M=4.43), Screen (M=4.88), Terminology and System Information (M=4.85), Learning (M=4.69) and System Capabilities (M=4.93). In terms of the results, the highest mean is System Capabilities (M=4.93), whereas the lowest mean is Overall Reaction to the System (M=4.43). The results of the students who are registered in GSNAS are as: Overall Reaction to the System (M=5.15), Screen (M=5.81), Terminology and System Information (M=5.63), Learning (M=5.45), and System Capabilities (M=5.34). In terms of the results, the highest mean is Screen (M=5.81), whereas the lowest mean is Overall Reaction to the System (M=5.15).

Table 10. User Satisfaction Means in terms of Institute Types

Categories/Items	GSSS		GSNAS		Total	
	M	SD	M	SD	M	SD
Overall Reaction to the System	4.43	1.91	5.15	1.82	4.78	1.90
Screen	4.88	1.98	5.81	1.72	5.33	1.91
Terminology and System Information	4.85	2.22	5.63	1.63	5.23	1.99
Learning	4.69	2.22	5.45	2.08	5.06	2.18
System Capabilities	4.93	2.13	5.34	1.95	5.13	2.05
Total	4.74	1.91	5.46	1.57	5.09	1.78

N=100

Moreover, the total satisfaction mean of students who are registered in GSNAS (M=5.46) are higher than that of the students who are registered in GSSS (M=4.74).
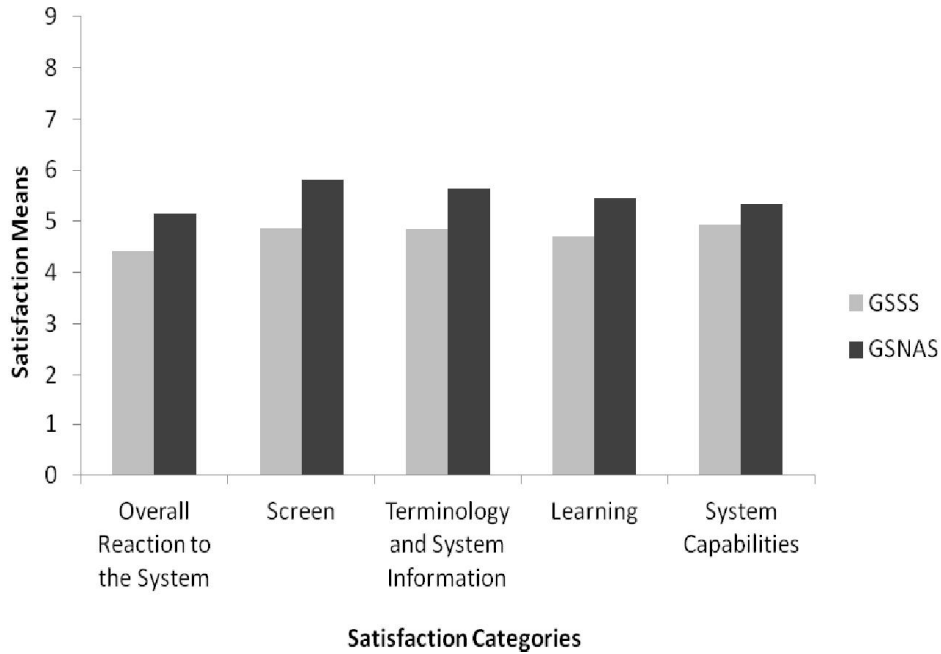
Figure 15. User Satisfaction Means in terms of Institute Types

In Figure 15, it is clear that the mean of students who are registered in GSNAS in the five categories are higher than students registered in GSSS means. However, to figure out whether there is a significant user satisfaction mean difference between the institute types or not, independent samples t-test was conducted with 95% level of confidence. However, before presenting the findings of the study, the needed assumptions (Appendix H) were checked for independent samples t-test.

Table 11. Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Satisfaction Total	Equal variances assumed	1.41	.24	2.00	98	.04	.70	.35
	Equal variances not assumed			2.02	96.75	.04	.70	.35

N=100

In terms of Table 11, it was concluded that there is a significant mean difference between the students who are registered in GSSS (M=4.74) or GSNAS (M=5.46); $t(98)=2.00$, p=0.04.

4.1.1. The Negative and The Positive Aspects of the FDP Information Portal according to the FDP students

The negative and the positive aspects of the FDP Information Portal were obtained from the QUIS. The questionnaire was filled by 100 FDP students from an online survey website; however, only 38 students wrote the negative and positive aspects of the system and the other 62 students wrote nothing. Each students wrote either the negative or the positive aspects, or wrote both of them. Table 12 presents the frequency of the negatives and positive aspects of the FDP Information System. Furthermore, detailed frequency information is in Appendix F.

Table 12. The Negatives and Positive aspects of the FDP Information Portal

The Aspects	Frequency
The Negative	
Lack of system content and guide	11
Lack of communication within the portal	8
Unreliability in system content	7
Difficulty of the approval process	7
Difficulty to use	6
Design Problems	5
Restrictions of authority	5
Giving error	2
Update Issue	2
Automatic intro Video	2
SubTotal	55
The Positive	
Easy access to the Portal	11
Seeing the information of all expenditure	11
Others	5
Being Open to Improvement	2
SubTotal	29
Total	84

N=38

Table 12 presents that FDP Information Portal has more negative aspects than positive aspects according to the FDP students. The first negative one is *Lack of system content and guide*, and the first positive ones are *Easy access to the Portal* and *Seeing the information of all expenditure.*

In negative aspects, *Lack of system content and guide* has the highest frequency, in this aspect most problems are about the main task that is creating project request and academic travel request. In creating project, accounting part is problematic issue, namely in the portal there is no descriptive information about accounting codes and types. Even, existing information about them are confusing. Moreover, in the system lack of guidance is another problematic issue. The second negative aspect is *Lack of communication within the Portal.* In this issue, waiting approval for requests is

problematic issue. To be accepted project or academic travel requests, the students should take approval from their thesis advisor, department chair, the institute to which they are registered, and FDP office. It is stated that to take approval fast, the communication in portal is weak. Moreover, lack of reminder e-mail or note about the important dates is in this part.

In positive aspects, both *Easy access to the Portal* and *Seeing the information of all expenditure* have the highest frequency. The subset of first aspect includes reaching the portal from everywhere and every time via internet. The subset of second aspect includes seeing the information of all expenditures about both project and academic travel. This information includes numerical, monetary and qualitative information. The portal includes the all expenditure of each FDP student.

4.2. The FDP Information Portal' Usefulness Score in terms of FDP students' Genders and Institute Types

To measure the usefulness score of the FDP Information Portal, System Usability Scale (SUS) was conducted. The scale consists of 10 item questionnaire with scale from 1("Strongly disagree") to 5("Strongly agree") Likert scale. To obtain the overall SUS score, multiply the sum of the item score contributions by 2.5. Thus, SUS scores range from 0 to 100 in 2.5-point increments. The system usability mean was measured in terms of both the students' genders and their institute types. Table 13 and Figure 16 presents the system usability scale means (M=50.90) of the FDP Information Portal in terms of the students' gender, Female (M=48.99) and Male (M=53.43).

Table 13. System Usability Scale Means in terms of Gender

	Female		Male		Total	
	M	SD	M	SD	M	SD
Total	48.99	15.37	53.43	17.12	50.90	16.21

Note. To obtain the overall System Usability Scale means, multiply the sum of the item score contributions by 2.5. Thus, SUS scores range from 0 to 100 in 2.5-point increments. N=100

However, to figure out whether there is a significant mean difference between the male and female FDP students' usefulness scores or not, independent-samples t test was conducted with 95% level of confidence. However, before presenting the findings of the study, the needed assumptions (Appendix H) were checked for independent samples t-test.

Table 14. Independet Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Usability Total	Equal variances assumed	.07	.80	-1.36	98	.18	-4.44	3.26
	Equal variances not assumed			-1.34	85.01	.18	-4.44	3.31

N=100

In terms of the Table 14, it was concluded that there is no significant mean difference between the male (M=53.43) and female (M=48.99) FDP students' usefulness scores, $t(98)= -1.36$, p=0.18.

Moreover, Table 15 and Figure 17 presents the system usability scale means in terms of the institute types, GSSS (M=48.13) and GSNAS (M=53.91).

Table 15. System Usability Scale Means in terms of Institute Type

	GSSS		GSNAS		Total	
	M	SD	M	SD	M	SD
Total	48.13	15.91	53.91	16.16	50.90	16.21

Note. To obtain the overall System Usability Scale means, multiply the sum of the item score contributions by 2.5. Thus, SUS scores range from 0 to 100 in 2.5-point increments. N=100. GSSS : Graduate School of Social Sciences, GSNAS: Graduate School for Natural and Applied Sciences

However, to figure out whether there is a significant mean difference between the students who are registered in GSSS or GSNAS, independent-samples t test was conducted with 95% level of confidence. However, before presenting the findings of the study, the needed assumptions (Appendix H) were checked for independent samples t-test.

Table 16. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Usability Total	Equal variances assumed	.25	.62	1.80	98	.08	5.78	3.21
	Equal variances not assumed			1.80	97.10	.08	5.78	3.21

N=100

In terms of Table 16, It was concluded that there is no significant mean difference between the usability score of students who are registered in GSSS (M=48.13) or GSNAS (M=53.91); $t(98)=1.802$, p=0.075.

4.3. The Relationship between the FDP Information Portal' Usefulness Score and the FDP Students Satisfaction Levels

Table 17 presents the relationships between the two variables, the FDP Information Portal' usefulness score and the FDP Students satisfaction levels.

Table 17. Pearson's Product Moment Correlations for User Satisfaction Level and System Usability Score

	System Usability Score	User Satisfaction Level
System Usability Score		
Pearson Correlation	1	$.72^{**}$
Sig. (2-tailed)		.00
N	100	100
User Satisfaction Level		
Pearson Correlation	$.72^{**}$	1
Sig. (2-tailed)	.00	
N	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

It was concluded that there is a positive correlation between User Satisfaction Level and System Usability Score, r=.72, p <.05, n=100.

Also, Figure 16 presents the scatter plot and it is seen that there is a positive correlation between User Satisfaction Level and System Usability Score.
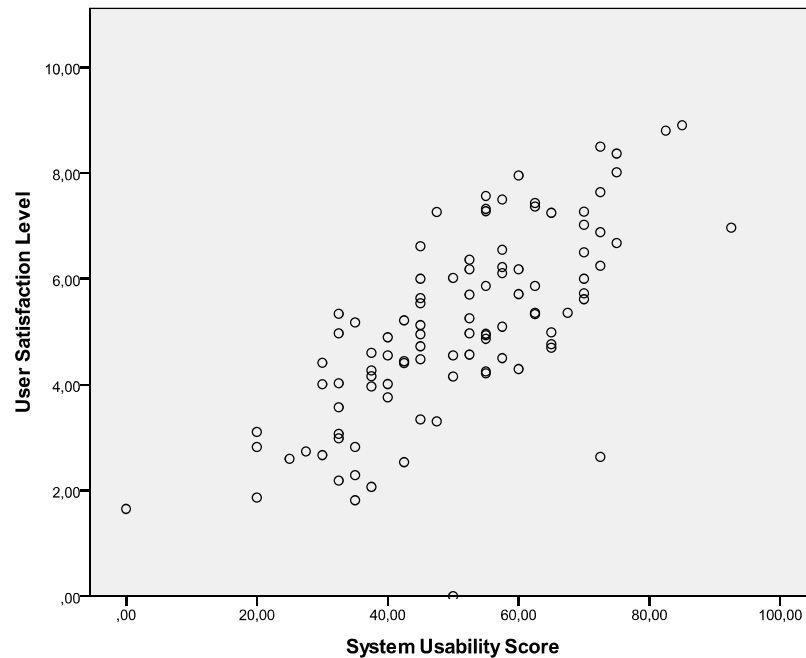
Figure 16. The Correlation between User Satisfaction Level and System Usability Score

4.4. The Usability Problems of the FDP Information Portal according to the FDP students when they perform the four main tasks on the portal

To find the usability problems of the FDP Information Portal, usability test including four main tasks(Appendix D) was conducted in HCI Laboratory with five FDP students, two of them are female and the remaining are males. In usability test, Eye-Tracking method, Concurrent Think-Aloud (CTA) technique was conducted. In Eye-Tracking analysis, eye movements consisting of two phases: Fixations and Saccades were examined. The eyes' positions are relatively stable during the fixations; however, the eyes' positions are moving during the saccade. Moreover, after the usability test, an interview related to tasks and general view of FDP Information Portal was conducted. Before the interview, the correct steps of each task were explained.

Table 18 presents the time spent of five subjects for each task. Each record of the subjects was divided scenes in Tobii Eye-Tracking Analysis Software and time was measured by taking into scenes consideration.

Table 18. Time Spent on Four Tasks for each subject

Subjects	Task1	Task2	Task3	Task4
1	2'04"	2'12"	2'24"	0'04"
2	2'10"	0'15"	1'33"	0'06"
3	2'08"	0'48"	2'05"	0'05"
4	3'30"	0'36"	2'23"	0'10"
5	0'30"	0'20"	0'36"	0'05"

To obtain statistic information from the data, the scene related to each task was divided areas of interest that are banner area, menu area, left frame and content area. The Figure 17 presents the division of scene.

Figure 17. The areas of interest of the FDP Information Portal

− Banner Area: It includes the banner of the portal, and there is no any information.

− Menu Area : It includes five menus that are, "Sayfam", "Kişisel Bilgilerim", "Projelerim", "Seyahatlerim" and "Yardım".

− Left Frame: It includes four parts that are "Tez Proje İşlemleri", "Bilgi", "Kılavuzlar" and "Belgeler/Formlar". And the sub-menus of each menu are shown in left frame. In other words, when "Projelerim" menu is selected, its submenus are shown in left frame. Figure 18 shows the left frame.

− Content Area : It shows content of the submenus/menus.

Figure 18. Left frame of the FDP Information Portal

In the usability test, for each area/frame, total fixation duration and fixation count were measured. In this way, it was known that which area/frame the subjects looked most and their eyes focused while the subjects were performing the tasks.

Task1

Task1 is as follows:

> "Tez çalışmanızda veri depolamak için bir adet 4 GB Flash Diske ihtiyaç duymaktasınız, toplam 50 TL harcayarak proje isteği oluşturunuz."

The tasks was performed completely by two subjects; however, even though some other subjects were not performed the task completely, the reasons were not based on

only subjects. Detailed analysis was explained part by part in terms of each subject. Table 19 presents overview of Task1 in terms of the subjects.

Table 19. Overview of Task1 in terms of the subjects

Subject	Most focused area	Difficulties encountered	Statement of subject
1	Left Frame	The needed "Yeni istek" button was inactive however subject did not realize it. She tried to find the button and when she felt lost, "Yardım" menu was used.	"I lost", "I gave up the task"
2	Left Frame	The subject followed the steps correctly; but, a problem was faced while he was filling the request form. In "Talep Tipi", "Talep Kalem Tipi," and "Hesap Kodu" area, he was confused.	"Account code and types of request are contradictory. I'm confused whether the flash disk is an external device or not"
3	Content Area	The subject followed the steps correctly; however, a problem was faced in "Talep Tipi", "Talep Kalem Tipi," and "Hesap Kodu" area in request form.	"Is USB Flash disk equipment or supplies, which one is correct? Should I select which account code? While I'm writing the disk' price, should I write Turkish currency?"
4	Content Area and Left Frame	First of all, the "Yeni istek" button was not active but the subject did not realize it. She used an only active button that is "Yeni istek" button but belonging to another issue (Yıllık Bütçe Listesi). After she realized that she was in the wrong page, she returned the	"The Flash Disk should be an equipment but I do not know where I should write it. I think I am in wrong page because there is not relevant button, I will try again because I think the

		main page and tried to find related button.	steps I followed were correct."
5	Left Frame	The subject knew the reason of being inactive of "Yeni istek" button and left the task1.	"The "Yeni istek" button is not active, to be an active, I should determine my annual budget. Because I did not determine it, I left the Task1. Normally, I can do it."

Table 20 presents the subjects' total fixation duration in task1 in terms of areas of interest in FDP Information Portal.

Table 20. The subjects' total fixation duration in Task1 in terms of areas of interest in FDP Information Portal

	Total Fixation Duration			
	Content Area	Left Frame	Menu Area	Banner Frame
Subject	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)
1	40.91	25.88	1.81	0.14
2	2.88	3.19	1.75	0.84
3	8.44	1.45	0.23	-
4	91.31	49.56	3.91	-
5	4.66	1.79	0.24	0.00

Subject1' the most focused area was left frame that is presented in Figure 21; however, according to the Table 33, the highest mean of total fixation duration is content area (M=40.91). The reason is that the help menu was used and the help

content was located in content area. The Subject2' the most focused area was left frame that is presented in Figure 23 and the highest mean is in Left Frame (M=3.19) in Table 20. The Subject3' the most focused area was content area that is presented in Figure 27 and the highest mean is content area (M=11.65) in Table 20. The Subjects4' the most focused areas were content area and left frame that is presented in Figure 31 and Table 20 presents that the highest mean is in content area (M=91,31). Because In Figure 31, there are four intense points and three of them are in content area. The last subject' most focused area is left frame; however, the content area has another intense area in Figure 34. The highest mean is in content frame (M=4,66).Moreover Table 21 presents the subjects' fixation count in task1 in terms of areas of interest in FDP Information Portal.

Table 21. The subjects' fixation counts in task1 in terms of areas of interest in FDP Information Portal

	Fixation Count			
	Content Area	Left Frame	Menu Area	Banner Frame
Subject	Mean (Count)	Mean (Count)	Mean (Count)	Mean (Count)
1	216.00	107.00	8.00	1.00
2	20.00	15.00	5.00	5.00
3	41.00	4.00	1.00	-
4	471.00	201.00	18.00	-
5	26.00	5.00	1.00	1.00

Subject1

The Figure 20 presents the Heat Map of the Task1 of Subject1. The legend in upper right corner presents the intensity of eye fixations. The most intensity color is red and the least is green. It is shown that the most intensity is in left frame of the portal. Subject focused more "Tez Proje İşlemleri" in left frame, Figure 19.

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Figure 19. "Tez Proje İşlemleri" part is in the left frame of the FDP Information Portal

The subject clicked the "İstek işlemleri" from the left frame and that was correct step; however, the task1 was not performed.
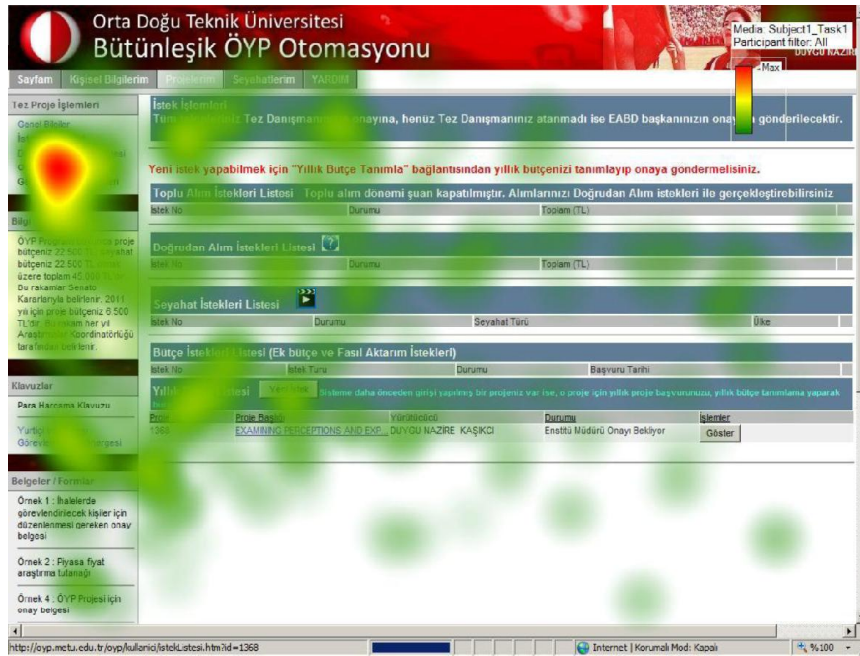
Figure 20. The Heat Map of the Task1 of Subject1

First of all, subject1 used the menu area and clicked the "Projelerim" menu. She stated that "I hate the portal" at the beginning of the test. The necessary button was inactive; however, she did not realize it and used another button. After she felt lost, the Help menu was used. She tried to find the correct active button but she did not. After she stated that "I'm lost now," and left the Task1.

Moreover, the Figure 21 presents the Gaze Plot of the Task1 of Subject1. Similarly, the size of circle presents the intensity of eye fixations. Unlike the Heat Map, the Gaze Plot presents both fixations and saccades. The number of circle shows the path that eyes followed. The subject tried to find the correct button/link. It is seen that the subject scanned almost all page to find the correct way.

Figure 21. The Gaze Plot of the Task1 of Subject1

After the usability test, an interview was conducted. In the interview, subject1 stated:

"The task was easy; however, there are another option to create a project request and I'm confused, I did not know which option is correct. When I create a project, I want my friends to help me because the system is so complicated. In the portal, we perform the specific tasks; however, for these tasks, different menus are used. In the portal there is no guidance, for example if I create an new request, the system directed me with forward button. Also the other buttons should be bigger."

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Subject2

The Figure 22 presents the heat map of the Task1 of Subject2. The most intensity color is red and the least is green. It is shown that the most intensity is in left frame of the portal. Subject focused more "Proje işlemleri" in the left frame. The subject followed the steps correctly and completed the task1.
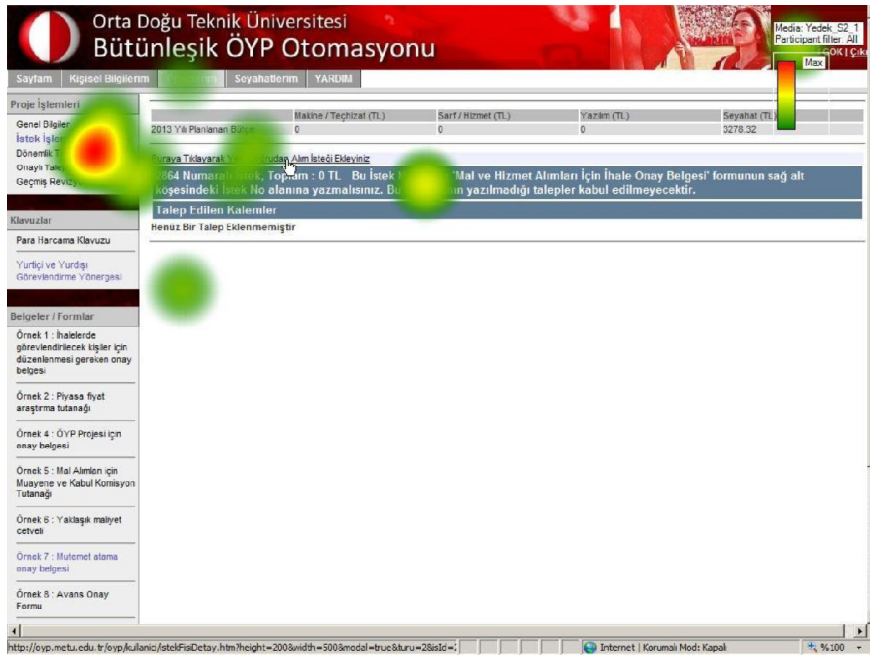
Figure 22. The Heat Map of the Task1 of Subject2

The Figure 23 presents the Gaze Plot of Task1 of Subject2. The fixation count is less than the subject1' fixation count because the subject2 did not try to find the correct link/button, he knows the steps so his fixation count is less than subject1' count.

Figure 23. The Gaze Plot of the Task1 of Subject2

The task1 was completed without a hitch by the Subject2; however, some problems were faced while the subject was filling the form to create the request. The Figure 24 presents the Heat Map of the request form of Task1.

Figure 24. The Heat Map of the Request Form of Task1

In the usability test, the subject2 progressed fluently; however, while he was filing the request form, he stated that "Account code is contradictory. I'm confused that the flash disk is a computer device or an external disk." The all account codes were read and the one was selected. After completed the Task1, Subject2 did not close the request form and continued that "The horizontal scrollbar is not useful, I found difficult how I close the request form window."

Moreover Figure 25 presents the Gaze Plot of the Request Form of Task1. It is shown that the fixations and saccades dispersed out of the Request Form to find the close icon.
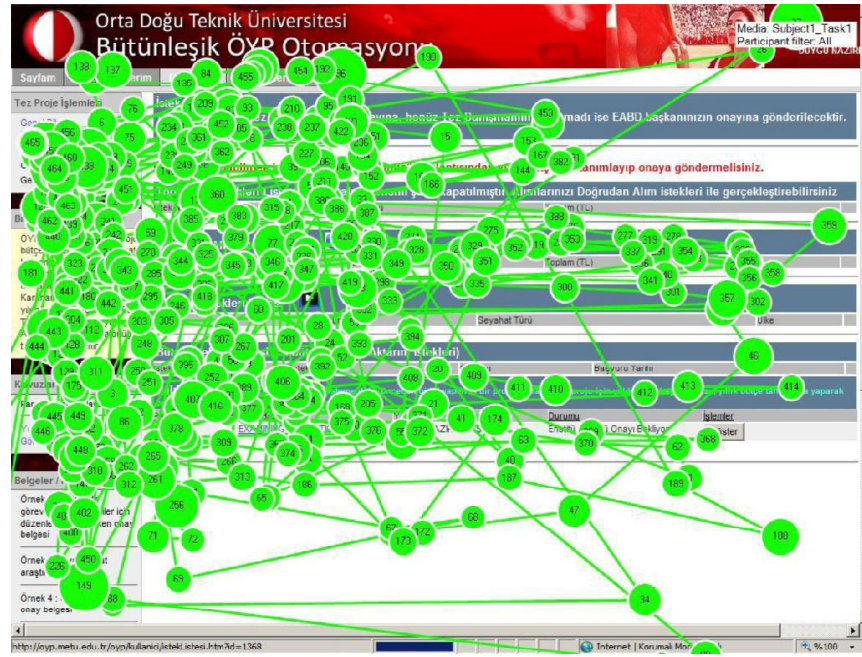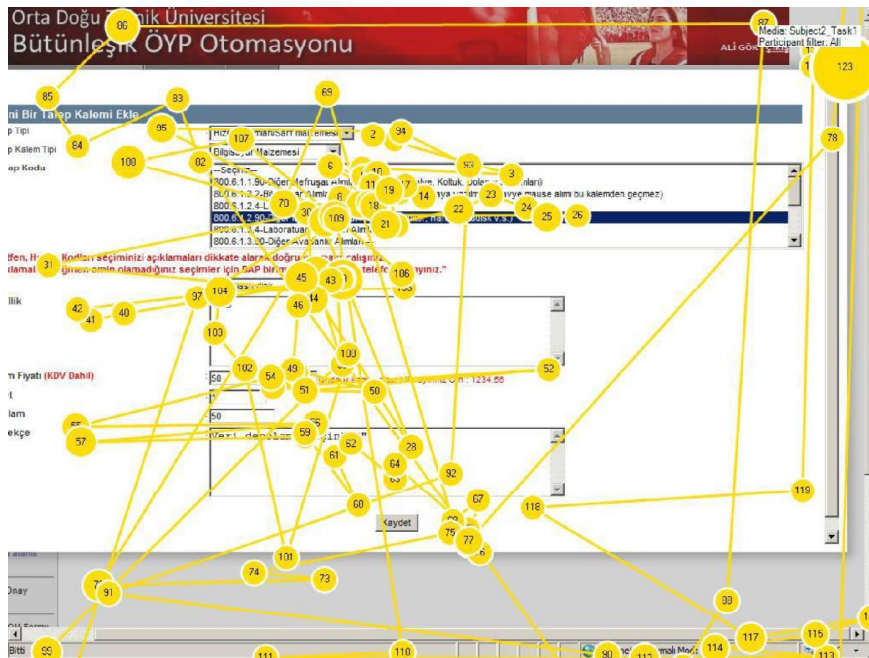

Figure 25. The Gaze Plot of the Request Form of Task1

After the usability test, an interview was conducted. In the interview, subject2 stated:

" The task1 was easy, but the specification is not known so I do not know the flash disk is an equipment or a supplies. There should be clear explanation about it. For example, there can be an explanation when the mouse hovers on account codes. Moreover, I have to click projects in menu area for request procedures, sometimes I

forget it where the request procedure. In the portal, there should be a place for only request procedures.

Subject3

The Figure 26 presents the Heat Map of the Task1 of Subject3. The most intensity color is red and the least is green. It is shown that the most intensity is in content area of the website. After clicked the "Proje İşlemleri" in left frame, the subject focused on the request list to create a new request. The task1 was completed correctly.
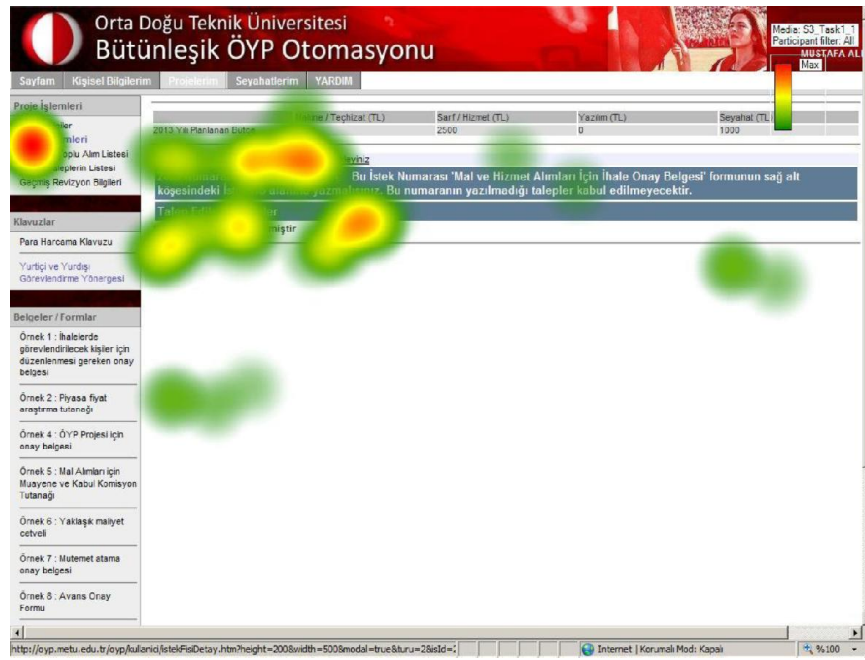
Figure 26. The Heat Map of Task1 of Subject3

Also Figure 27 presents the Gaze Plot of Task1 of Subject3.
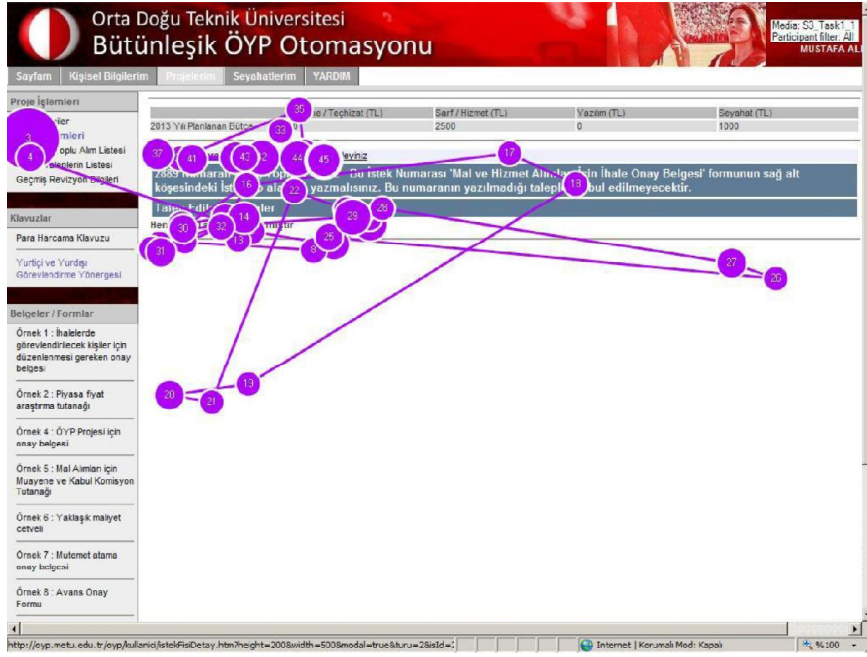
Figure 27. The Gaze Plot of Task1 of Subject3

The Figure 28 presents the Heat Map of the request form of Task1. Although the subject followed the correct steps, a problem was faced during filling out the request form. It was stated that " Is USB Flash disk equipment or supplies, which one is correct? I should select which account code? While I was writing the price of the flash disk, should I write Turkish currency?".
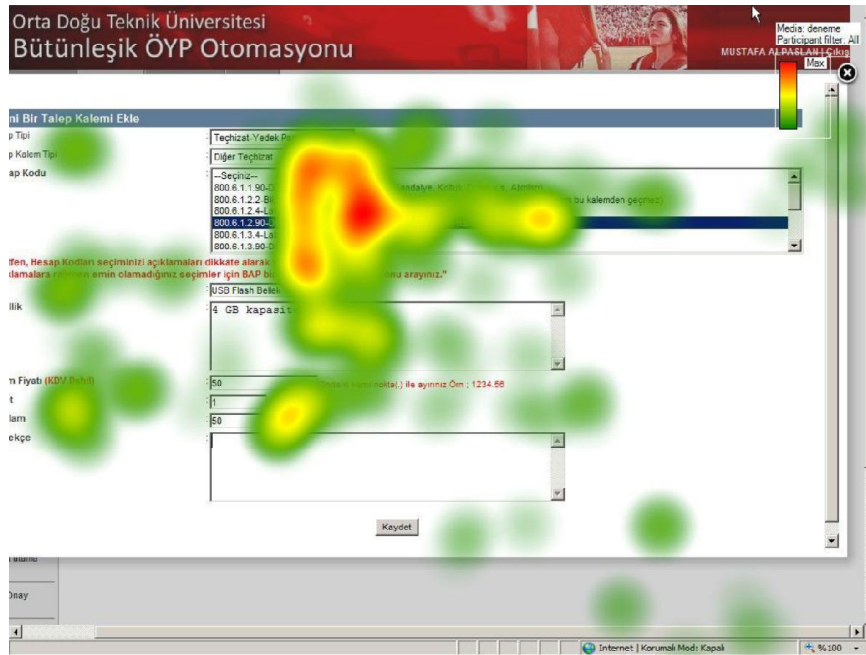
Figure 28. The Heat Map of the Request Form of Task1

The red color intensity area is account code and the subject3 did not make sure about account code and the all codes was examined. Also Figure 29 presents the Gaze Plot of the Request Form of Task1. The fixation intensity is on account code area.
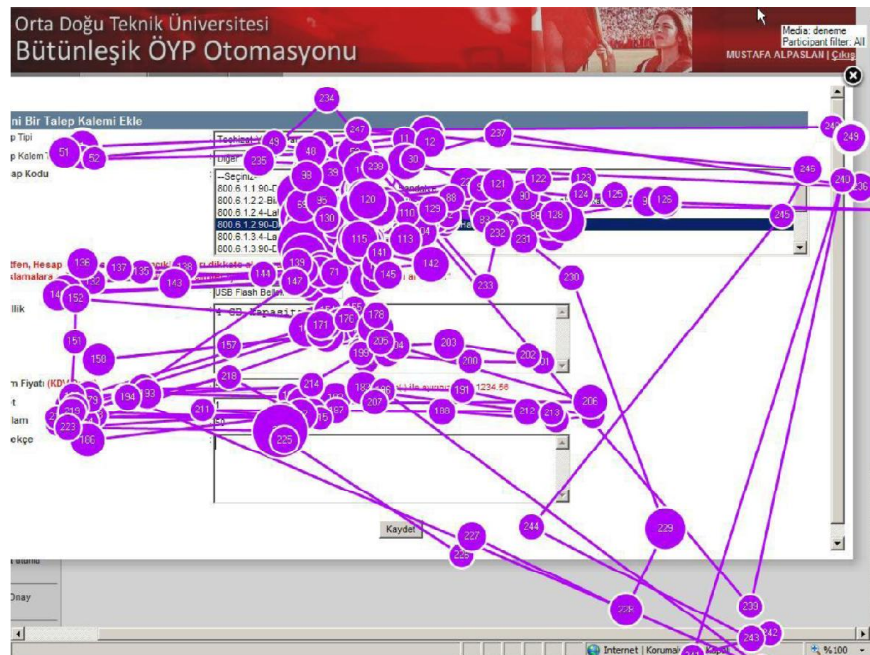
Figure 29. The Gaze Plot of the Request Form of Task1

After the usability test, in the interview, the subject stated that,

"The task was easy; however, I do not know flash disk is an equipment or supplies. To select the correct item, I generally call the FDP Office. There is a classification problem. There should be a guide that helps us for account code and account type. "

Subject4

The Figure 30 presents the Heat Map of the Task1 of Subject4. It is shown that the most intensity areas that are content area and left frame are changeable. Figure 31 presents the Gaze Plot of the Task1 of Subject4. The number of saccades shows that the subject scanned the page.
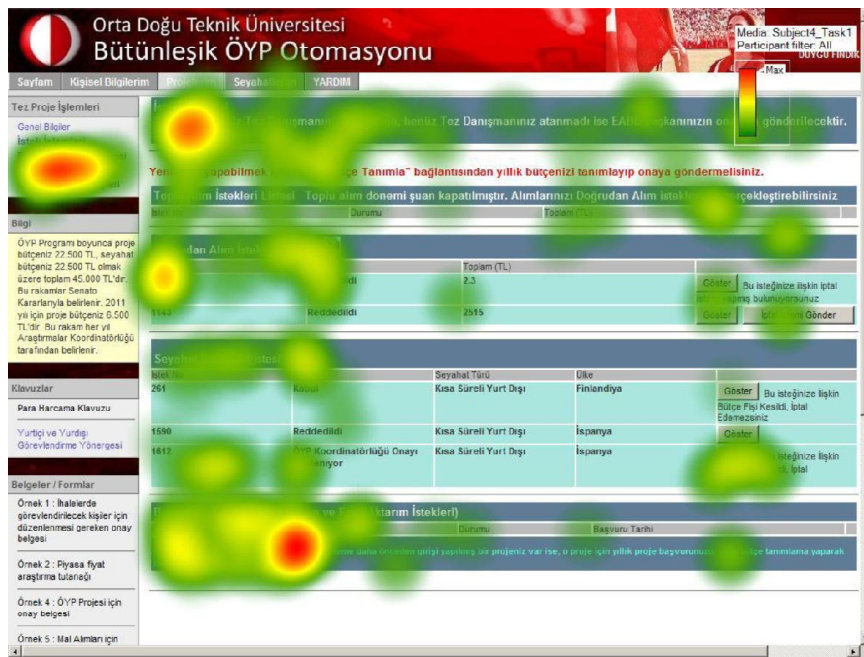
Figure 30. The Heat Map of the Task1 of Subject4
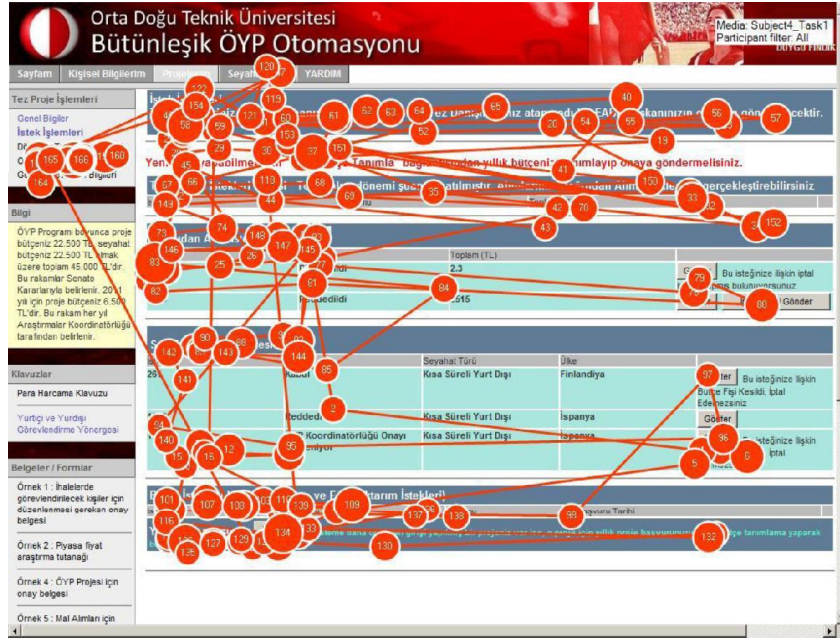
Figure 31. The Gaze Plot of the Task1 of Subject4

The Figure 32 presents the content area of subject4' account in FDP Information Portal. The "Yeni istek" button of "Doğrudan Alım İstekleri Listesi" was inactive. The Subject clicked the bottom button that is "Yeni istek" button but not belong to the Task1. It belongs to "Yıllık Bütçe Listesi".

Figure 32. The content area of Subject4 account' in FDP Information Portal

The subject tried to complete the task and stated that " The Flash Dish should be an equipment but I do not know where I should write the Flash Disk. I think I am in wrong page." After subject realized the wrong page, the main page was returned back. The subject continued that " There is not relevant button, I tried again because I think the steps I followed were correct. I could not find the "Yeni istek" button. I left the task."

However in the interview, subject stated that "the task was easy but the system is complicated. Normally while I am creating a new request for project or academic travel, I get help from my FDP friends. After clicking "Projelerim" menu, request procedure is seen; however, it is not clear which steps that i should follow, I create a request procedure by the method of trial and error."

After each task, the correct steps were shown to the subjects. After the explanation, the subject state " before buy a flash disk, I should determine my annual budget (Yıllık Bütçe). I did not determine it so the button was not active; however, there is no any warning about it on the portal and I do not know when I should determine my annual budget". However in Figure 32 presents the red-highlighted warning but the subject did not read it. The subject continued that "The system can send mail to the users for reminding the annual budget or when we log in the system, it shows warning about it. Moreover, I'm confused with "determining annual budget" (Yıllık Bütçe Belirleme) and "creating a new request" (Yeni İstek Oluşturma). The two concepts are confused, two of them have "new request" (Yeni istek) button.

Subject5
The Figure 33 presents the Heat Map of the Task1 of Subject5. It is shown that the most intensity is in left frame. Figure 34 presents the Gaze Plot of the Task1 of Subject5. The number of saccades shows that the subject scanned the page. The "new request" button was inactive.
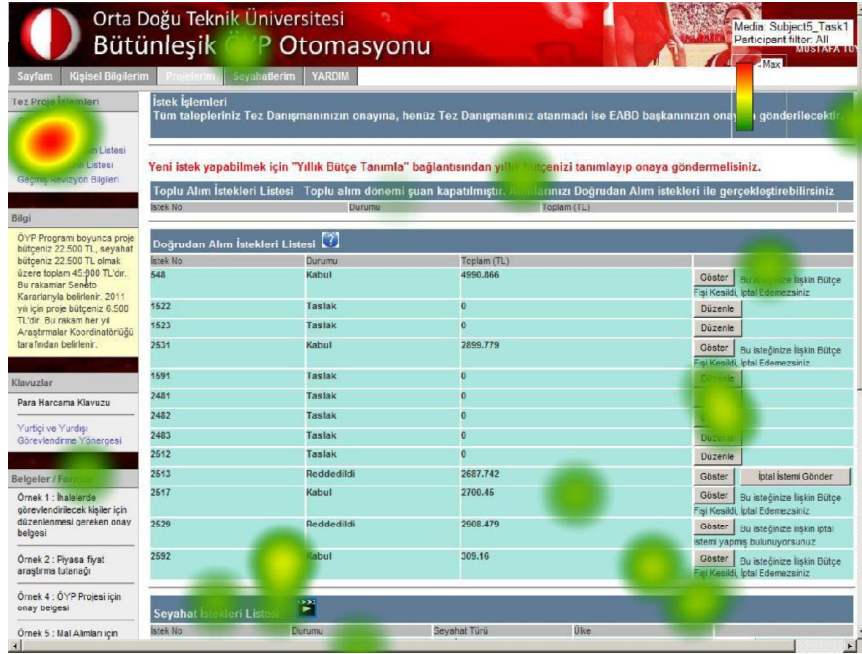
Figure 33. The Heat Map of the Task1 of Subject5

Figure 34. The Gaze Plot of the Task1 of Subject5

The Subject5 did not perform the Task1 because of inactive new request button. Unlike the other subjects, Subject5 stated that "The "Yeni istek" button is not active,

to do a new request I should determine my annual budget. Because I did not determine it, I left the Task1 but normally I can perform the task."

In the interview, Subject5 continued that "The task was easy, I reach all information from the portal and see the my approved requests in the request process menu. Also I see how many budget I have or in which process my requests."

Task2
Task2 is as follows,

"Portal'da "Proje Onay Sürecini" gösteren grafiği/tabloyu bulunuz."

Task2 was performed successfully by one subject. The other subjects thought that they did correctly but not and these subjects followed almost same steps to find the answer. Table 22 presents overview of Task2 in terms of the subjects.

Table 22. Overview of Task2 in terms of the subjects

Subject	Most focused area	Difficulties encountered	Statement of subject
1	Left Frame and Content Area	Subject clicked all alternatives (Figure 20) in "Tez Proje İşlemleri" in left frame.	"I lost again. I wish there is a search button so I can search by keyword."
2	Content Area	Subject clicked all alternatives (Figure 20) in "Tez Proje İşlemleri" in left frame.	"The answer should be in "İstek işlemler"".
3	Left Frame	Subject clicked all alternatives (Figure 20) in "Tez Proje İşlemleri" in left frame.	"The answer is here (istek işlemleri) or other place"

4	Left Frame	-	"The answer should be in Help Menu"
5	Content Area	Subject clicked all alternatives (Figure 20) in "Tez Proje İşlemleri" in left frame.	"I found the answer, it is in "Onaylı Talepler Listesi" in left frame"

The statistics information of task2 was explained as follows. Table 23 presents the subjects' total fixation duration in task2 in terms of areas of interest in FDP Information Portal.

Table 23. The subjects' total fixation duration in task2 in terms of areas of interest in FDP Information Portal

	Total Fixation Duration			
	Content Area	Left Frame	Menu Area	Banner Frame
Subject	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)
1	29.21	28.79	4.69	8.04
2	14.64	2.19	0.18	-
3	16.99	13.12	-	-
4	0.96	7.72	2.71	-
5	2.73	0.29	-	0.16

The intensities of some heat map of subjects are different from the data of Table 23. Subject1' the most focused areas were left frame and content area that is presented in Figure 36, in similarly, the highest mean of total fixation duration are left frame (M=28,79) and content area (M=29,21) in Table 23. The Subject2' the most focused area was content area that is presented in Figure 38 and the highest mean is in

content area (M=14,64) in Table 23. The Subject3' the most focused area were left frame and content area in Figure 40 and the highest mean is content area (M=16,99); however, the other highest mean is in left frame (M=13,12) in Table 23. The Subjects4' the most focused area were left frame that is presented in Figure 42 and Table 23 presents that the highest mean is in left frame (M= 7,72). The last subject' the most focused area was content area and in Table 23 it is seen that the highest mean is in content area (M= 2,73). Moreover Table 24 presents the subjects' fixation count in task2 in terms of areas of interest in FDP Information Portal.

Table 24. The subjects' fixation count in task2 in terms of areas of interest in FDP Information Portal

	Fixation Count			
	Content Area	Left Frame	Menu Area	Banner Frame
Subject	Mean	Mean	Mean	Mean
	(Count)	(Count)	(Count)	(Count)
1	135.00	100.00	22.00	41.00
2	77.00	7.00	1.00	-
3	78.00	43.00	-	-
4	7.00	29.00	10.00	-
5	19.00	2.00	-	2.00

Subject1

The Figure 35 presents the Heat Map of the Task2 of Subject1. It is shown that the most intensity is in left frame of the portal. Subject focused more the left frame, especially to "Tez Proje İşlemleri" that contains "Genel Bilgiler", "İstek İşlemleri", "Dönemlik Toplu Alım Listesi", "Onaylı Taleplerin Listesi" and "Geçmiş Revizyon Bilgileri". The subject clicked the all alternatives in "Tez Proje İşlemleri" area.
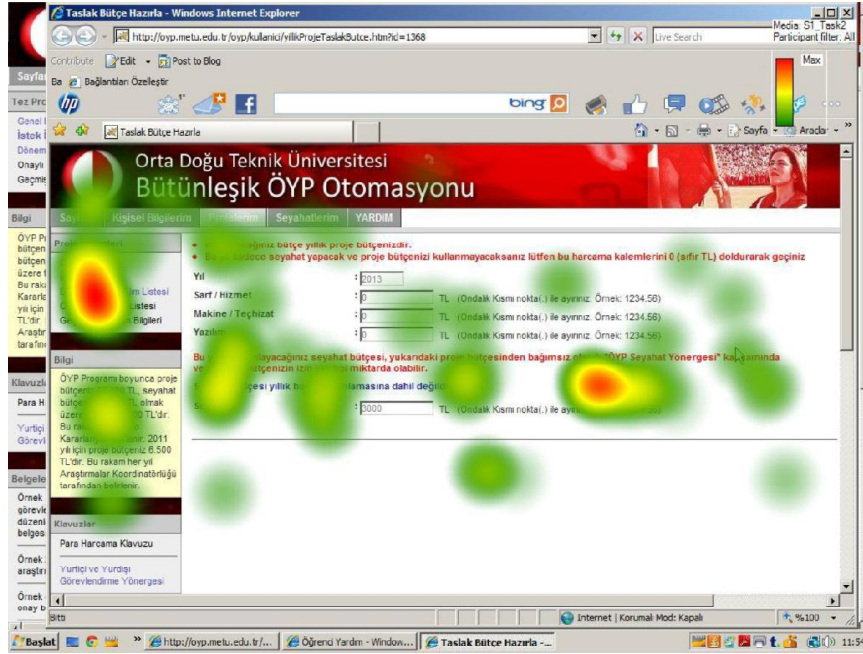
Figure 35. The Heat Map of the Task2 of Subject1

The Subject1 did not perform the Task2 and even the subject opened a new page on the screen unconsciously and continued in the new page. The subject1 tried to find the answer by clicking the alternatives in "Tez Proje İşlemleri" area. The content of alternatives were shown in content area and after read each content, subject1 thought that she had found the answer at every turn and stated that "I think I found" and continued that "I'm lost again. I wish there is a search button so I can search the answer by keyword. I left the task2" .

Moreover, the Figure 36 presents the Gaze Plot of the Task2 of Subject1. Similarly, the size of circle presents the intensity of eye fixations. Unlike the Heat Map, the Gaze Plot presents both fixations and saccades. The number of circle shows the path that eyes followed. The subject tried to find the correct answer.
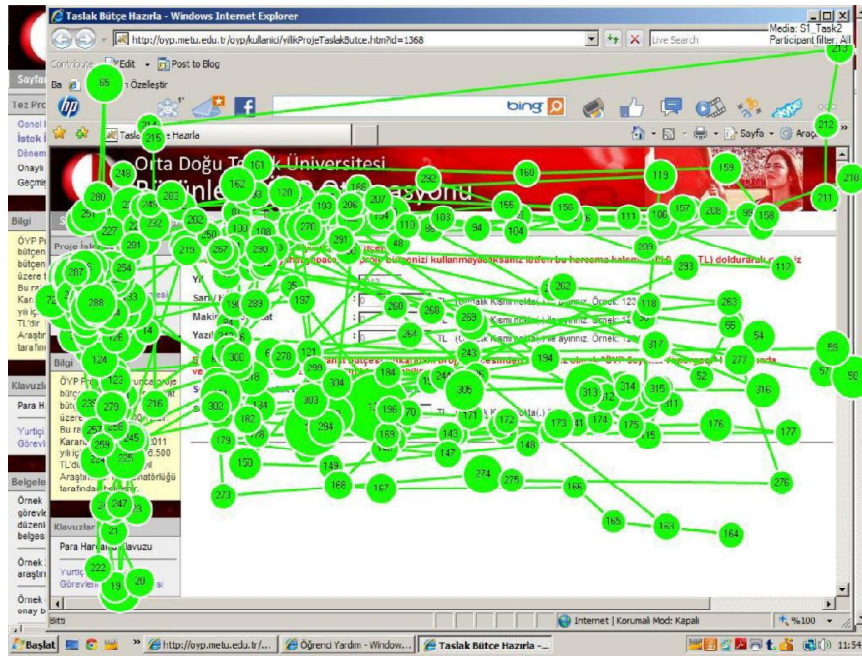
Figure 36. The Gaze Plot of the Task2 of Subject1

After the usability test, an interview was conducted. The answer was in Help menu so a question was asked about it. In the interview, subject1 stated:

"I do not remember whether before I used Help menu or not .I'm lost again in task2; however, there could be a search button so I could find the answer."

Subject2

The Figure 37 presents the heat map of the Task2 of Subject2. It is shown that the most intensity is in content area of the portal. Subject2 also focused the left frame, especially to "Tez Proje İşlemleri" that contains "Genel Bilgiler", "İstek İşlemleri", "Dönemlik Toplu Alım Listesi", "Onaylı Taleplerin Listesi" and "Geçmiş Revizyon Bilgileri". Similar to Subject1, Subject2 used the links in "Tez Proje işlemleri" and read the all content to be sure.
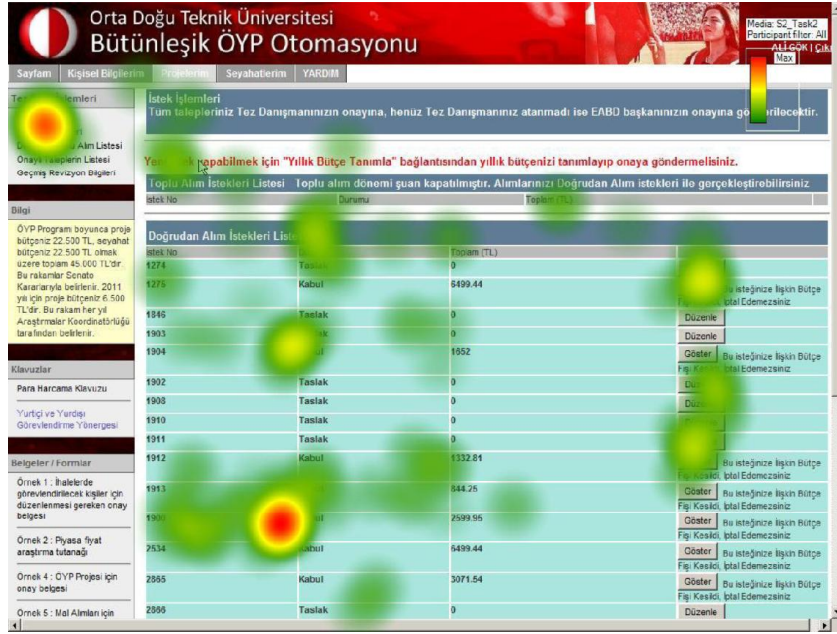
Figure 37. The Heat Map of the Task2 of Subject2

While the subject2 was reading the each content of the links in "Tez Proje İşlemleri", it was stated that "I think, the answer can be here" without being sure. However, subject2 left the taks2 as if he completed correctly.The Figure 38 presents the Gaze Plot of Task2 of Subject2.
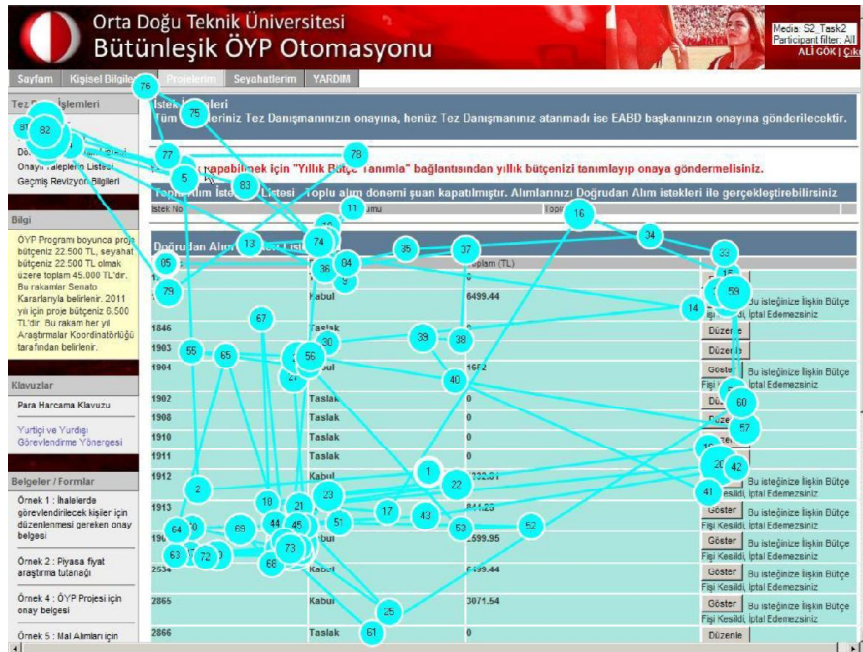
Figure 38. The Gaze Plot of the Task2 of Subject2

After the usability test, in interview Subject2 continued "The answer is shown in page and task2 was easy". About help menu, subject2 stated "I have never used the Help Menu".

Subject3

The Figure 39 presents the Heat Map of the Task2 of Subject3. It is shown that the most intensity is in left frame of the website.

Figure 39. The Heat Map of Task2 of Subject3

Also Figure 40 presents the Gaze Plot of Task2 of Subject3.
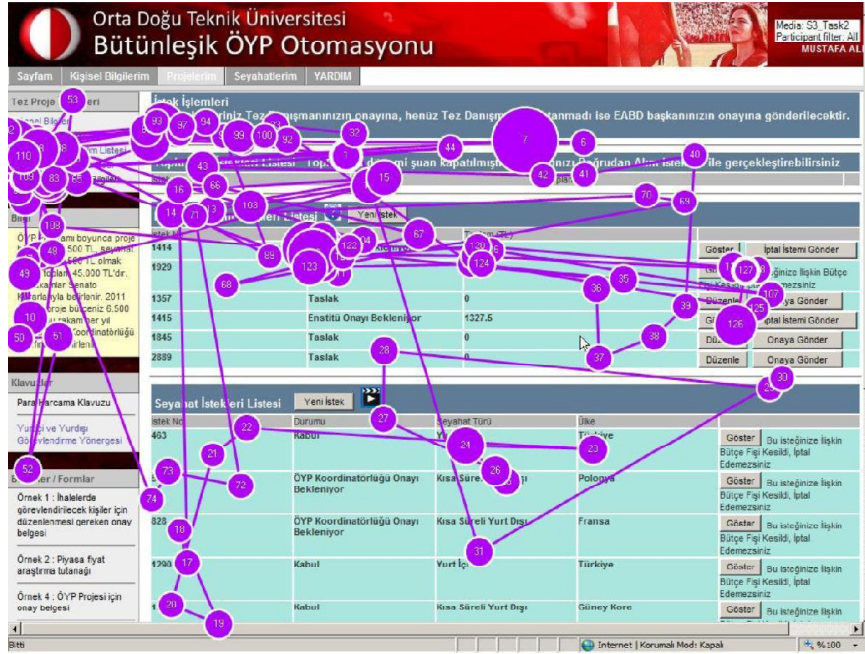
Figure 40. The Gaze Plot of Task2 of Subject3

As previous subjects, the subject3 used the links in "Tez Proje İşlemleri" and stated " the answer should be here (istek işlemleri)". Sujbect3 left the task2 without being sure.

After the usability test, in the interview, the subject stated " The task was easy, I thought that I found the answer because the portal is simple". About Help menu, subject3 continued "I have never used the Help Menu".

Subject4

The Figure 41 presents the Heat Map of the Task2 of Subject4. It is shown that the most intensity area is in left frame. There are three intense areas and two of them are in left frame the other one is in menu area. Also, Figure 42 presents the Gaze Plot of the Task2 of Subject4. The number of saccades shows that the subject scanned the page.

Figure 41. The Heat Map of the Task1 of Subject4
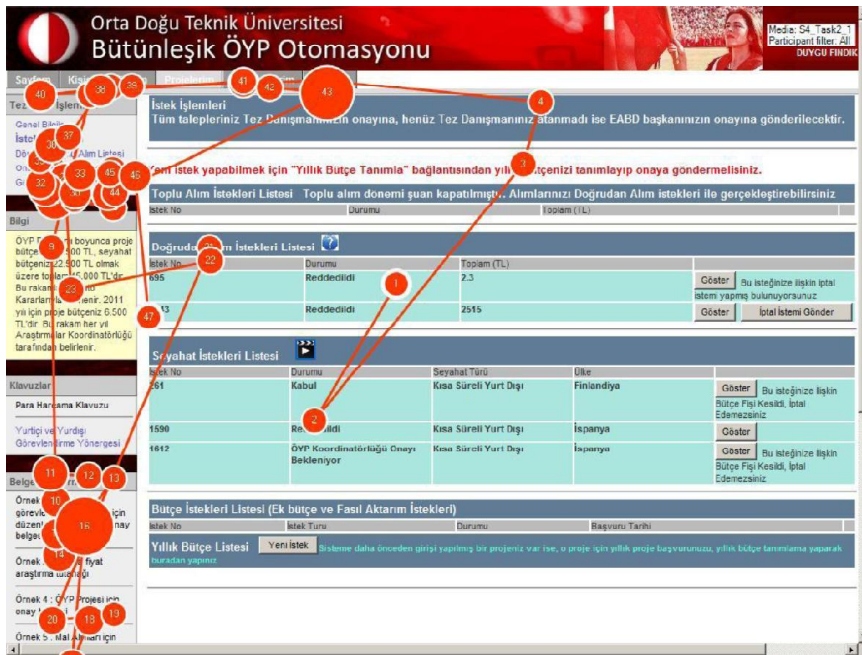
Figure 42. The Gaze Plot of the Task1 of Subject4

Firstly, as previous subjects, the subject4 focused the "Tez Proje İşlemleri" in left frame. Also subject4 read the document and form names in left frame. Finally

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subject4 stated "The answer should be in Help Menu". After read the content in Help menu, the subject4 found the answer".

In the interview, subject4 stated " I have never used the Help Menu; however, I guessed that the answer is there".

Subject5

The Figure 43 presents the Heat Map of the Task2 of Subject5. It is shown that the most intensity is in content area. There are one more than intense areas because subject5 read the content of each links in "Tez Proje İşlemleri" in left frame. Figure 44 presents the Gaze Plot of the Task2 of Subject5. The number of saccades shows that the subject scanned the page.
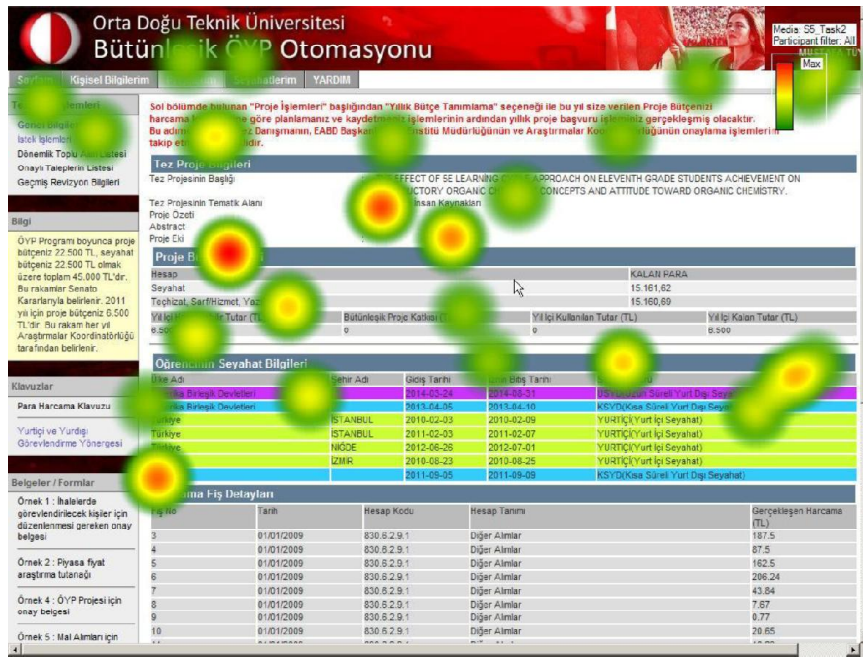
Figure 43. The Heat Map of the Task1 of Subject5
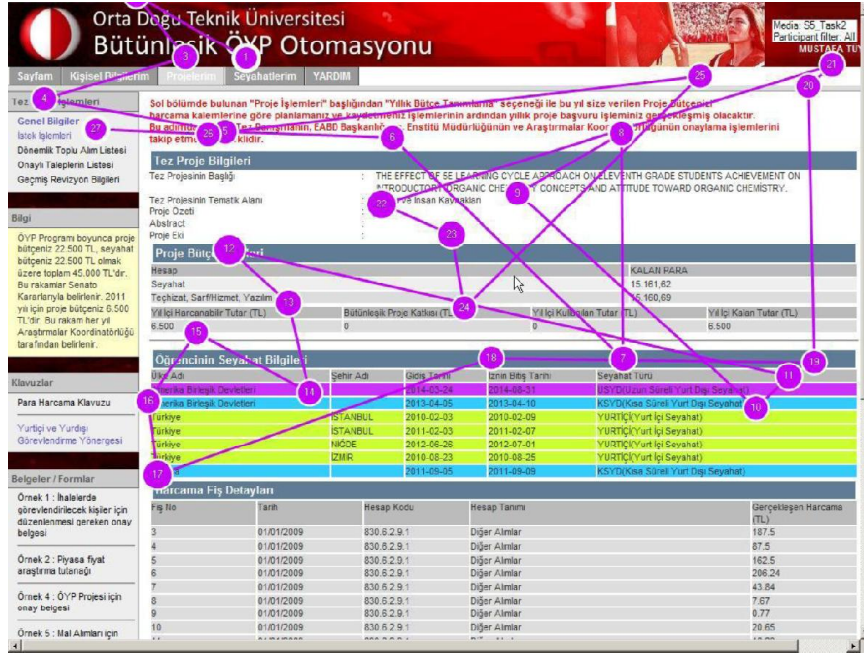
Figure 44. The Gaze Plot of the Task1 of Subject5

"İstek işlemleri" and "Genel Bilgiler" in "Tez Proje İşlemleri" in left frame were used. The subject5 did not perform the task; however, he assumed that he found the answer and left the task. After the usability test, in interview he stated, "The task was easy and I did not slog" and about help menu, subject5 continued "I have never used it before".

Task3

Task3 is as follows,

> "Bildiri sunmak amacıyla, İstanbul'da 4-7 Aralık 2013 tarihleri arasında gerçekleşecek olan Bilişim Konferansı için bir seyahat isteği oluşturunuz. Bu seyahat ÖYP destekli olup, tez danışmanınız bulunmamaktadır. Uçak gidiş-geliş 500 TL, konferans için de 1000 TL gerekmektedir."

Task3 was performed successfully by two subjects that performed Task1 correctly because Task1 and Task3 have similar steps. Even though some other subjects were not performed the task completely, the reasons were not based on only subjects. Detailed analysis was explained part by part. Table 25 presents overview of Task3 in terms of the subjects.

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Table 25. Overview of Task3 in terms of the subjects

Subject	Most focused area	Difficulties encountered	Statement of subject
1	Left Frame	The "Yeni istek" button was inactive, the red-highlighted warning about the inactive button was read but the subject did not figure out it.	"I should find the active button, however there is no guide about it".
2	Left Frame	-	"I follow the same step in task1"
3	Content Area	Firstly, subject used wrong menu (Seyahatlerim) and when he realized it, used correct menu(Projelerim).	"In "Seyahatlerim" menu, I can see previous academic travels I went, to create a request for a new academic travel, I use "Projelerim" menu. "
4	Content Frame	(The related button is not active).Firstly, subject used the wrong menu (Seyahatlerim) and when she realized that the other menu (Projelerim) should be used. Subject tried to find active related button.	"There is a "Seyahatlerim" menu but I create a request for academic travel by using "Projelerim" menu. I'm confused why there is a "Seyahatlerim" option.
5	Content Area	-	"To create a academic travel request, first of all I should determine my annual budget so I left the task"

The statistics information of task3 was explained as follows. Table 26 presents the subjects' total fixation duration in task3 in terms of areas of interest in FDP Information Portal.

Table 26. The subjects' total fixation duration in task3 in terms of areas of interest in FDP Information Portal

| | Total Fixation Duration | | | |
| | Content Area | Left Frame | Menu Area | Banner Frame |
Subject	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)
1	49.75	32.32	6.46	5.38
2	2.88	3.19	1.75	0.84
3	8.88	2.61	2.81	-
4	53.53	27.75	7.60	-
5	9.47	0.49	-	0.24

The intensities of some heat map of subjects are different from the data of Table 26. Subject1' the most focused area was left frame that is presented in Figure 45, but the highest mean of total fixation duration are content area (M=49,75), this is because new request form is located in content area. The Subject2' the most focused area was left frame that is presented in Figure 47 and the highest mean is in left frame (M=3,19) in Table 26. The Subject3' the most focused area was content area that is presented in Figure 49 and the highest mean is content area (M=8,88). The Subjects4' the most focused area was content area that is presented in Figure 51 and Table 26 presents that the highest mean is in content area (M=53,53). The last subject' the most focused area was content area and in Table 26 it is seen that the highest mean is in content area (M= 9,47).

Moreover Table 27 presents the subjects' fixation count in task3 in terms of areas of interest in FDP Information Portal.

Table 27. The subjects' fixation count in task3 in terms of areas of interest in FDP Information Portal

	Fixation Count			
	Content Area	Left Frame	Menu Area	Banner Frame
Subject	Mean (Count)	Mean (Count)	Mean (Count)	Mean (Count)
1	252.00	129.00	28.00	30.00
2	20.00	15.00	5.00	5.00
3	40.00	14.00	6.00	-
4	267.00	108.00	31.00	-
5	72.00	5.00	-	2.00

Subject1

The Figure 45 presents the Heat Map of the Task3 of Subject1. It is shown that the most intensity is in left frame of the portal. Subject focused more the left frame, especially "Tez Proje İşlemleri" area. Also two menus that are "Seyahatlerim" and "Projelerim" were used in menu area.
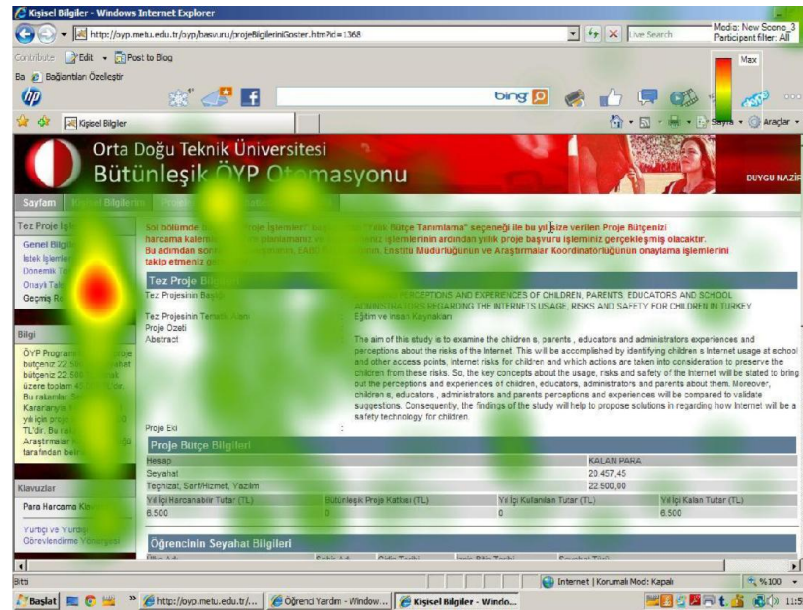
Figure 45. The Heat Map of the Task3 of Subject1

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The Subject1 did not perform the Task3. The help video related to creating an academic travel was watched and she tried to find academic travel request button. "Seyahatlerim" menu was used, there were only previous academic travels' information so she returned the main page. The red-highlighted warning about the creating an new request was read but she stated that she could not understand the warning.

Moreover, the Figure 46 presents the Gaze Plot of the Task3 of Subject1. Similarly, the size of circle presents the intensity of eye fixations. Unlike the Heat Map, the Gaze Plot presents both fixations and saccades. The number of circle shows the path that eyes followed. The subject tried to find the correct answer.
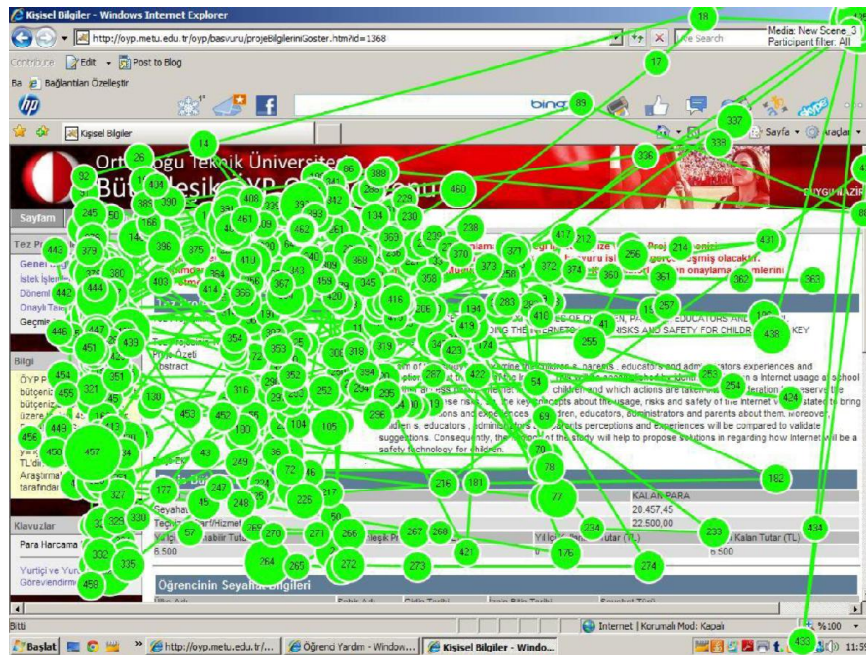
Figure 46. The Gaze Plot of the Task3 of Subject1

After the usability test, an interview was conducted.. In the interview, subject1 stated:

"There can be a warning why I did not create an academic travel request. I do not know why the "Yeni istek" button is inactive. The system is complex and I want my FDP friends to help me, when I create a new academic travel request".

Subject2

The Figure 47 presents the heat map of the Task3 of Subject2. Filling the academic travel request form. Subject2 followed the same steps in Task1 and completed the Task3 successfully. Task1 and Task3 have the same steps.
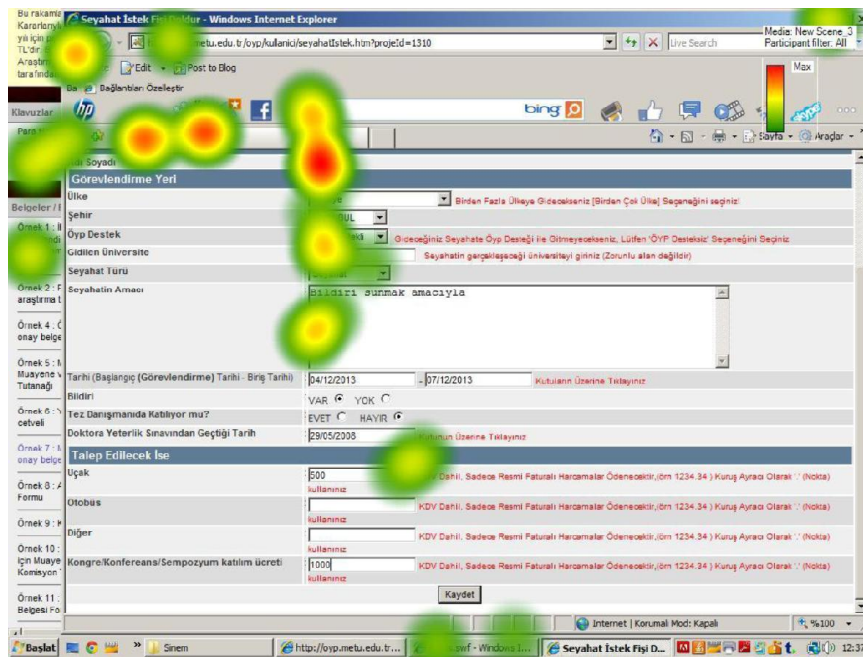
Figure 47. The Heat Map of the Task3 of Subject2

The Figure 48 presents the Gaze Plot of Task3 of Subject2.
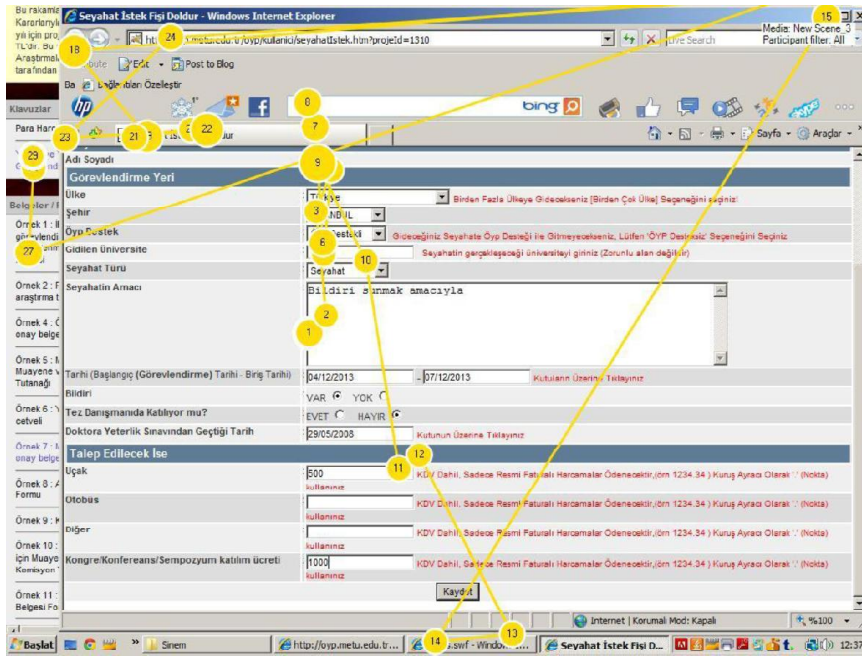
Figure 48. The Gaze Plot of the Task3 of Subject2

After the usability test, in interview Subject2 continued, "the task3 was comparatively easy, I often create a new academic travel request so in each I create a new one, I feel myself as I create it for first time. However, after creating academic travel once or twice, there is no need for getting help from FDP friends".

Subject3

The Figure 49 presents the Heat Map of the Task3 of Subject3. The subject followed the correct steps and completed the task3 successfully. The subject stated "The task3 has same steps with Task1. First I click the "Projelerim" and I select the "İstek İşlemleri" and to create an academic travel I clickted "Yeni istek" button near the "Seyahat istekleri Listesi".
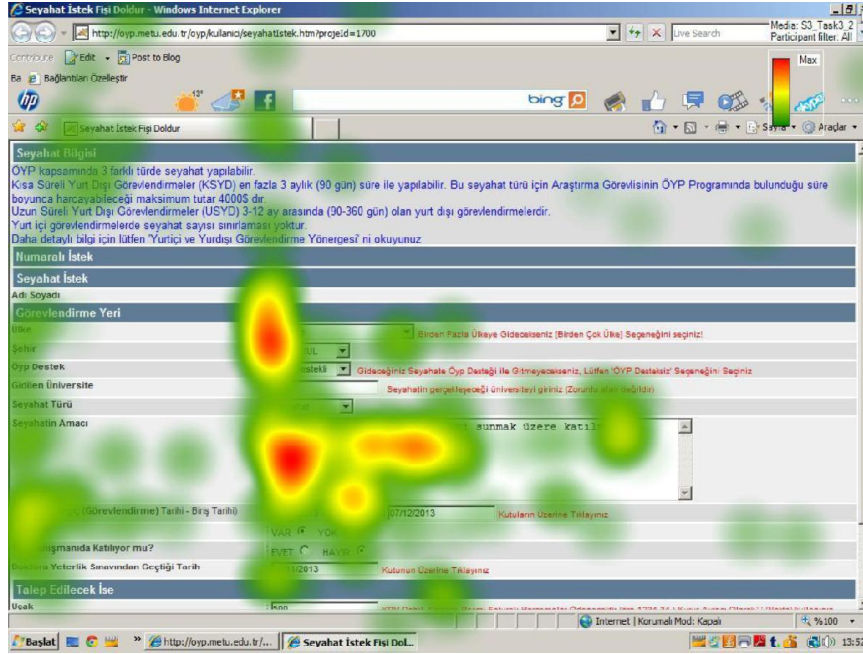
Figure 49. The Heat Map of Task3 of Subject3

Also Figure 50 presents the Gaze Plot of Task3 of Subject3.

Figure 50. The Gaze Plot of Task3 of Subject3

After the usability test, in the interview, the subject stated " The task was easy, however there is a problem. To create an academic travel, I used "Projelerim" menu, and I select "Yeni istek" button near the "Seyahat istekleri Listesi"; however there is another "Seyahatlerim" menu that I do not use it for this purpose. Therefore there is no need for "Seyahatlerim" menu".

Subject4

The Figure 51 presents the Heat Map of the Task3 of Subject4. It is shown that the most intensity areas that are content area and left frame are changeable. There are three intense areas and two of them are in content frame. Also, Figure 52 presents the Gaze Plot of the Task3 of Subject4. The number of saccades shows that the subject scanned the page.
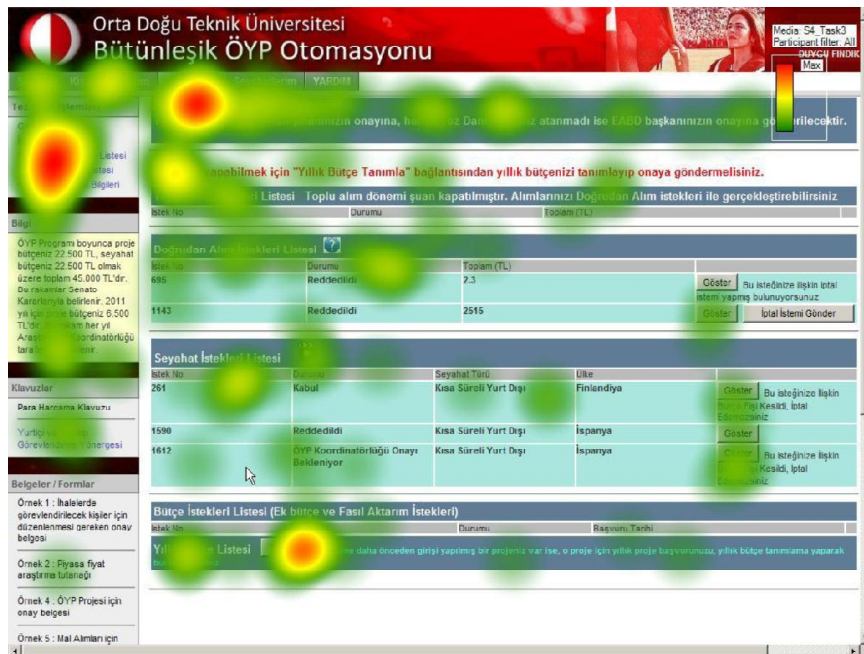
Figure 51. The Heat Map of the Task3 of Subject4
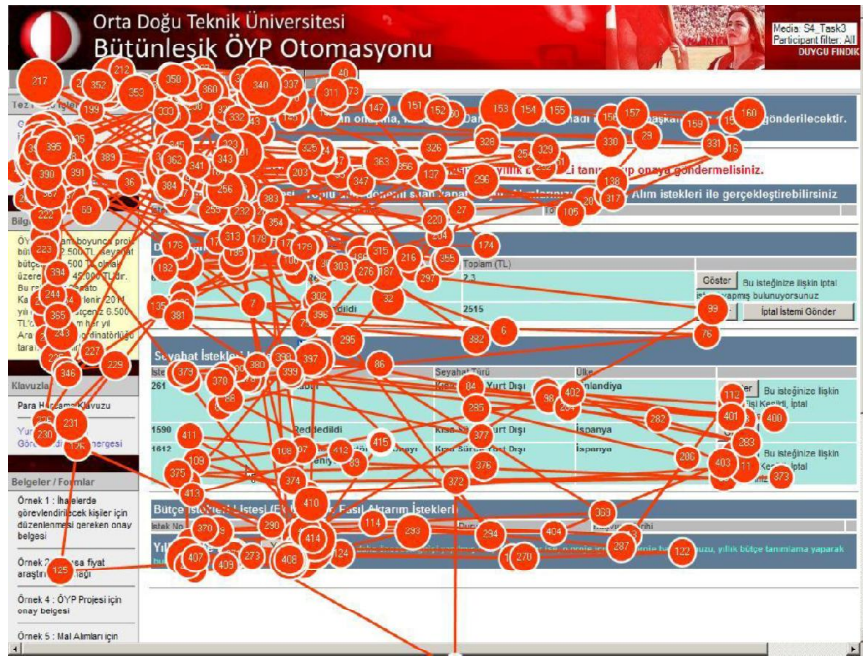
Figure 52. The Gaze Plot of the Task3 of Subject4

First of all, the subject4 used the "Seyahatlerim" menu in menu area. Because there is no any button, she clicked "Projelerim" menu and stated "I should create an academic travel request by using "Projelerim"; however, there is no active button. I'm confused, because there is another link as "Seyahatlerim" menu. There are so many links but no links deliver me answer. If I faced this problem in real life, I would call the FDP office because there is a problem in the system."

After the usability test, in the interview subject4 stated,

"The task was easy; however, it is not clear which steps we should follow. I use trial and error method to create a new request. The system was not organized well because I create requests by trying".

Subject5

The Figure 53 presents the Heat Map of the Task3 of Subject5. It is shown that the most intensity is in content area. Also, Figure 54 presents the Gaze Plot of the Task3 of Subject5. The number of saccades shows that the subject scanned the page.

Figure 53. The Heat Map of the Task3 of Subject5
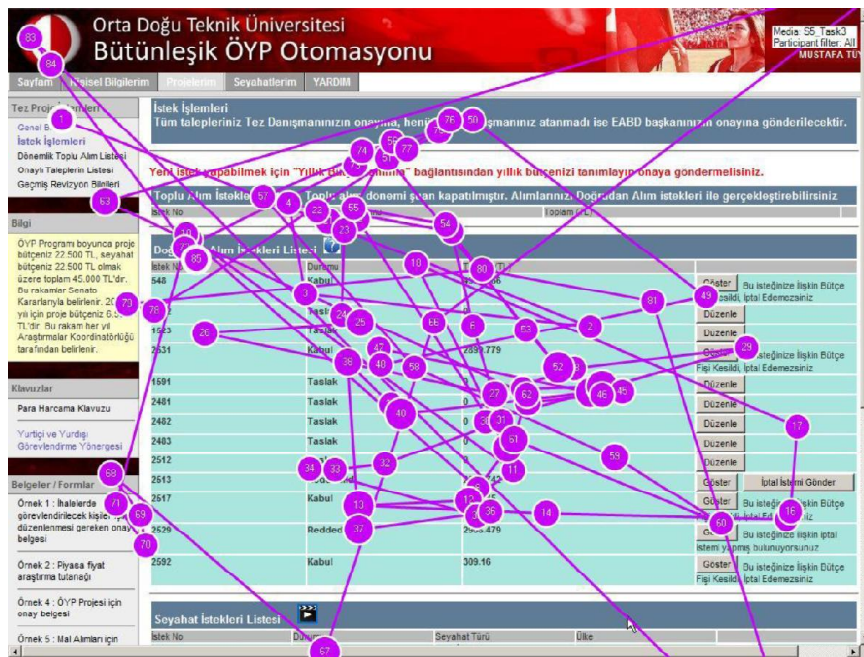
Figure 54. The Gaze Plot of the Task3 of Subject5

The subject used the "Projelerim" menu in menu area and selected "İstek işlemleri" from "Tez Proje İşlemleri" part. He stated " I create a new request and send it for

approval; however, to do this, I should determine my annual budget". He opened his previous approved academic travel request and explained how he filled the academic travel form. After the explanation, he left the task3. Moreover in the interview, he state that he does not get help from his FDP friends.

Task4

Task4 is as follows,

> "Portal'da "Yurtiçi ve Yurtdışı Görevlendirme Yönergesi" kılavuzunu bulunuz."

Task4 was performed successfully by all subjects and no subjects faced any problem. Table 28 presents overview of Task4 in terms of the subjects.

Table 28. Overview of Task4 in terms of the subjects

Subject	Most focused area	Difficulties encountered	Statement of subject
1	Left Frame	-	"I found it easy in guide option"
2	Left Frame	-	"It should be in document/forms parts "
3	Left Frame	-	"It is in guide part"
4	Left Frame	-	"It should be in guide part"
5	Left Frame	-	"It should be here (guide part)"

The statistics information of task4 was explained as follows. Table 29 presents the subjects' total fixation duration in task4 in terms of areas of interest in FDP Information Portal.

Table 29. The subjects' total fixation duration in task4 in terms of areas of interest in FDP Information Portal

| | Total Fixation Duration | | | |
| | Content Area | Left Frame | Menu Area | Banner Frame |
Subject	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)	Mean (Seconds)
1	0.82	2.51	-	-
2	-	1.97	-	-
3	0.73	2.27	-	-
4	0.07	1.18	-	-
5	-	0.90	0.4	-

The intensities of some heat map of subjects are same from the data of Table 29. Subject1' the most focused areas were left frame that is presented in Figure 56, in similarly, the highest mean of total fixation duration are left frame (M=2,51).The Subject2' the most focused area was left frame that is presented in Figure 57 and the highest mean is in left frame (M=1,97) in Table 29. The Subject3' the most focused area was left frame that is presented in Figure 59 and the highest mean is left frame (M=2,27). The Subjects4' the most focused area was left frame that is presented in Figure 61 and Table 29 presents that the highest mean is in left frame (M= 1,18). The last subject' the most focused area was left frame and in Table 29 it is seen that the highest mean is in left frame (M= 5,03). Moreover Table 30 presents the subjects' fixation count in task4 in terms of areas of interest in FDP Information Portal.

Table 30. The subjects' fixation count in task4 in terms of areas of interest in FDP Information Portal

	Fixation Count			
	Content Area	Left Frame	Menu Area	Banner Frame
Subject	Mean (Count)	Mean (Count)	Mean (Count)	Mean (Count)
1	5.00	6.00	-	-
2	-	12.00	-	-
3	4.00	8.00	-	-
4	1.00	5.00	-	-
5	-	5.00	1.00	-

Subject1

The Figure 55 presents the Heat Map of the Task4 of Subject1. It is shown that the most intensity is in left frame of the portal. Subject focused more "Kılavuzlar" part in the left frame and completed the task4 successfully.
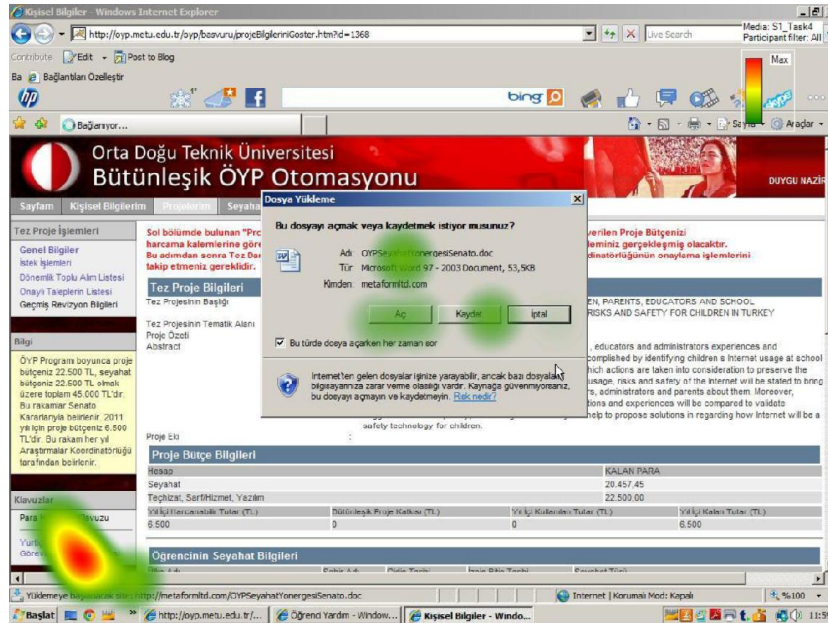
Figure 55. The Heat Map of the Task4 of Subject1

Moreover, the Figure 56 presents the Gaze Plot of the Task4 of Subject1. It is seen that the subject looked at the "Kılavuzlar" part to find the guide.
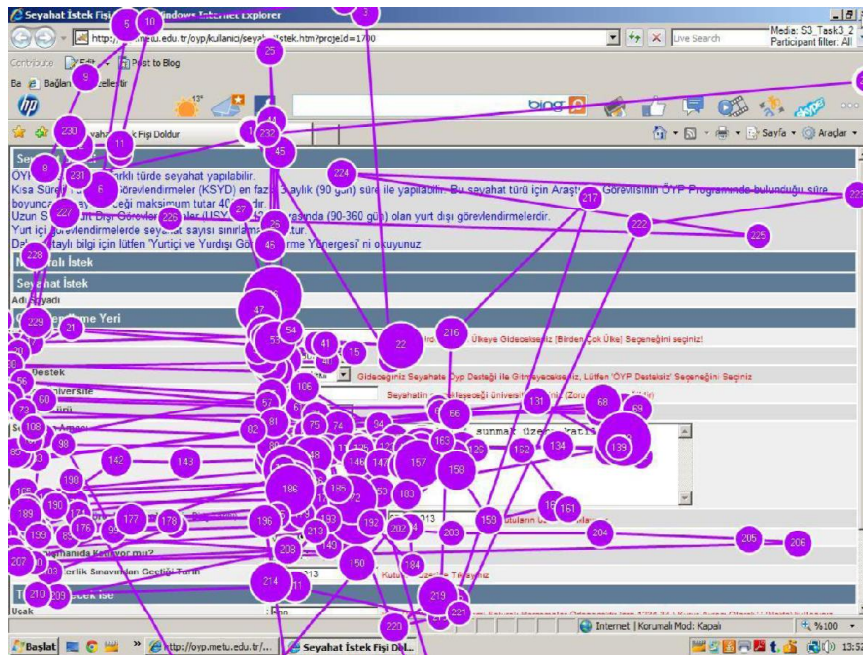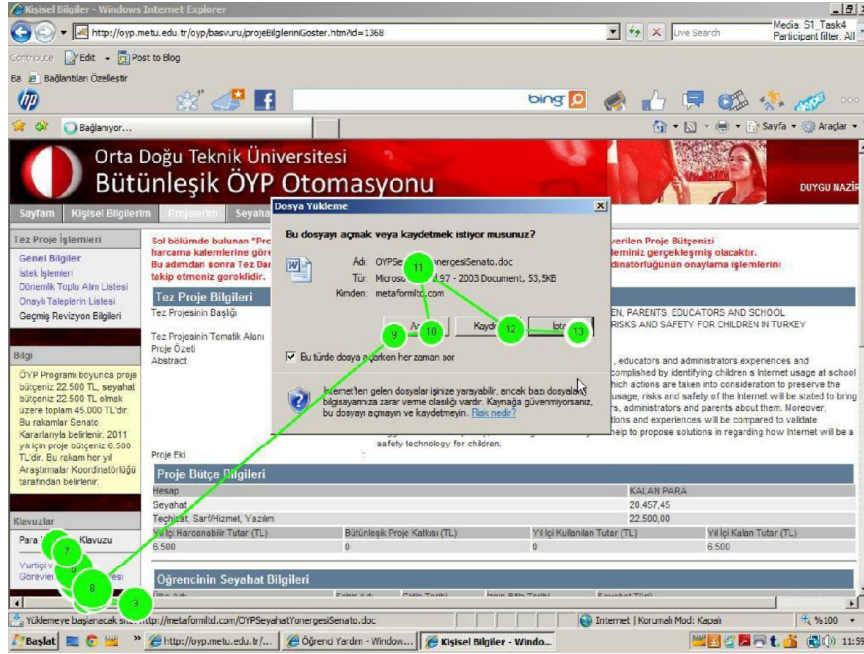

Figure 56. The Gaze Plot of the Task4 of Subject1

After the usability test, in the interview, subject1 stated "Task was easy, I found the needed guide under the guide part".

Subject2

The Figure 57 presents the heat map of the Task4 of Subject2. It is shown that the most intensity is in left frame.
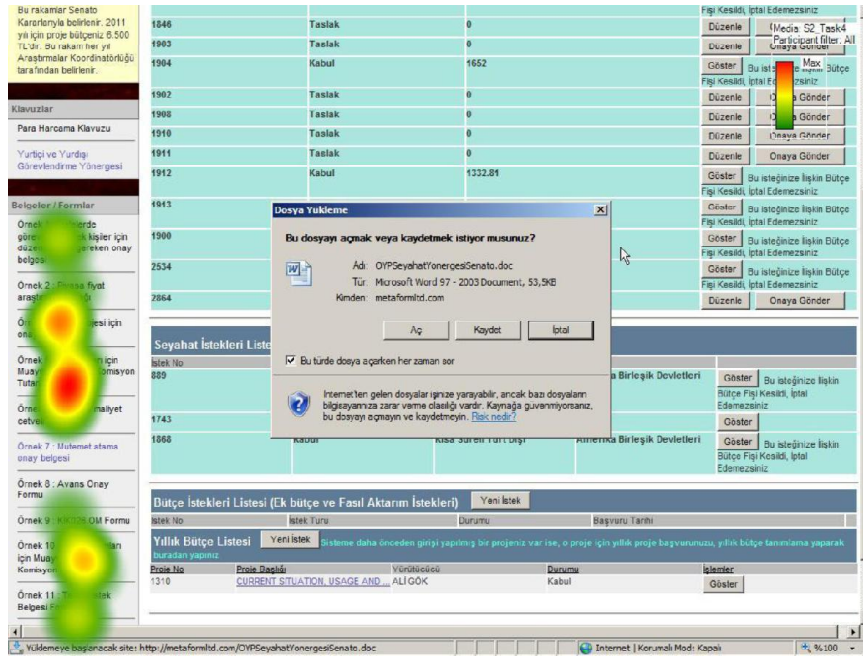
Figure 57. The Heat Map of the Task4 of Subject2

First of all, he focused "Belgeler/Formlar" parts and finally found the needed guide under the guide part. The Figure 58 presents the Gaze Plot of Task4 of Subject2. The paths that the subject2' followed are seen clearly in Figure 58.
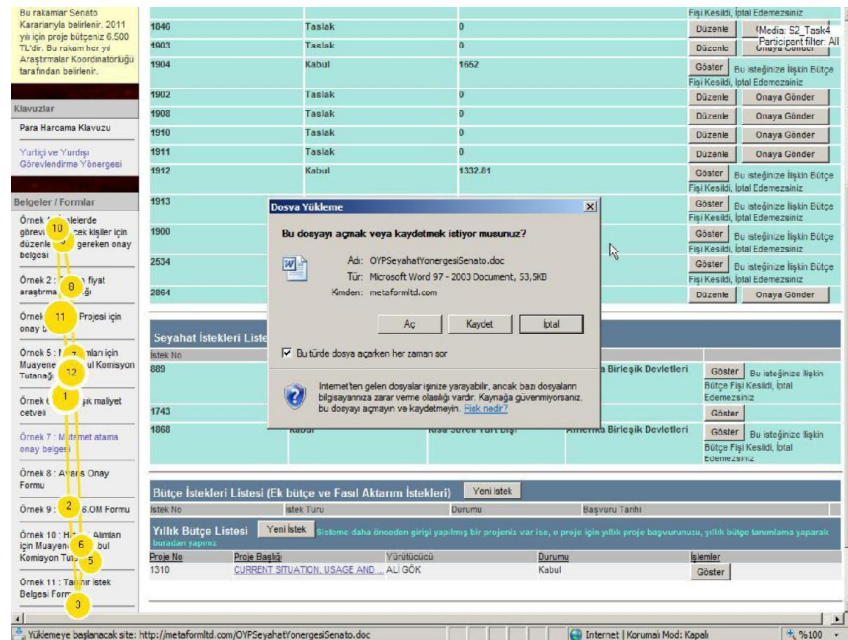
Figure 58. The Gaze Plot of the Task4 of Subject2

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After the usability test, in interview Subject2 expressed " The documents are seen in left frame but there should be discrete part for them. I found the file by chance".

Subject3

The Figure 59 presents the Heat Map of the Task4 of Subject3. It is shown that the most intensity is in "Kılavuzlar" part in left frame. Also Figure 60 presents the Gaze Plot of Task4 of Subject3. It is seen that the subject looked at first guide part.
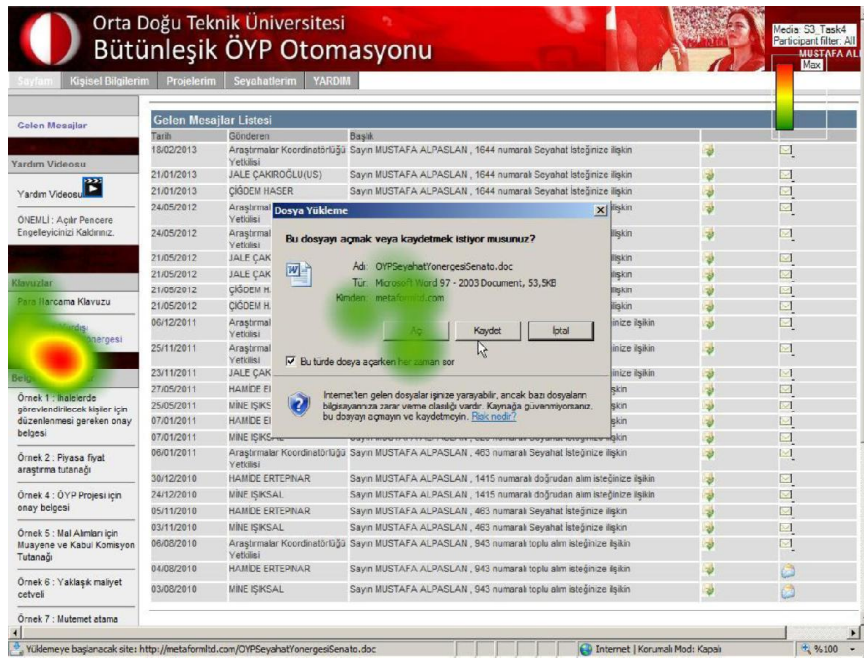
Figure 59. The Heat Map of Task4 of Subject3
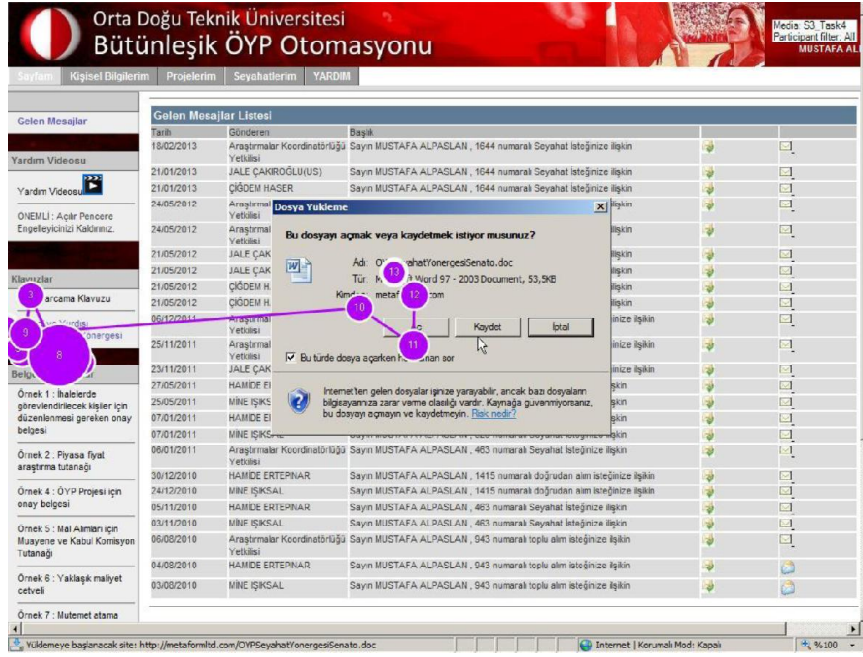
Figure 60. The Gaze Plot of Task4 of Subject3

After the usability test, in the interview, the subject stated " There are guides, documents and forms in the left frame but when I clicked "Kişisel Bilgilerim" menu, there are also documents and forms and this is confusing.

Subject4

The Figure 61 presents the Heat Map of the Task4 of Subject4. It is shown that the most intensity area is in left frame. Also, Figure 63 presents the Gaze Plot of the Task4 of Subject4. The number of saccades shows that the subject scanned the page.

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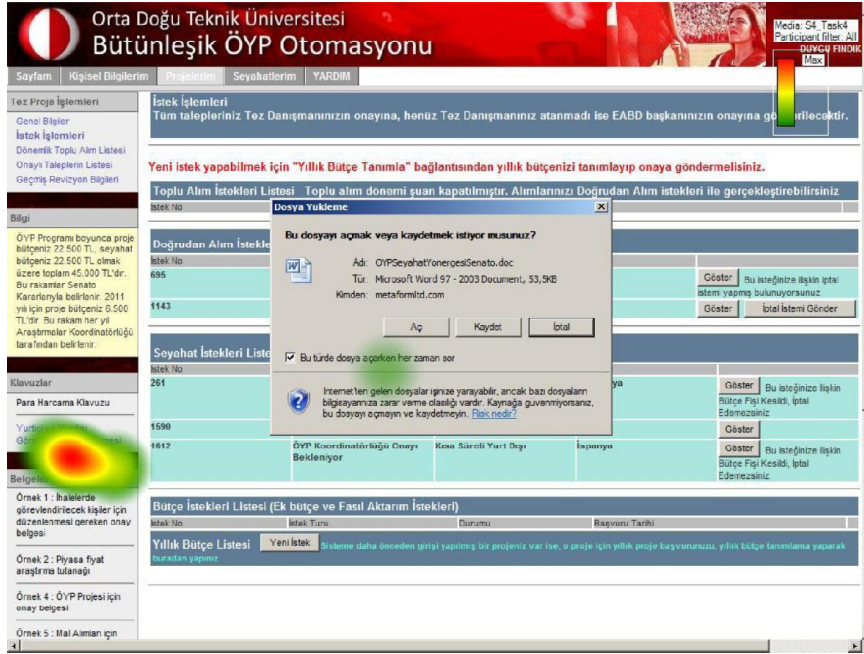
Figure 61. The Heat Map of the Task4 of Subject4
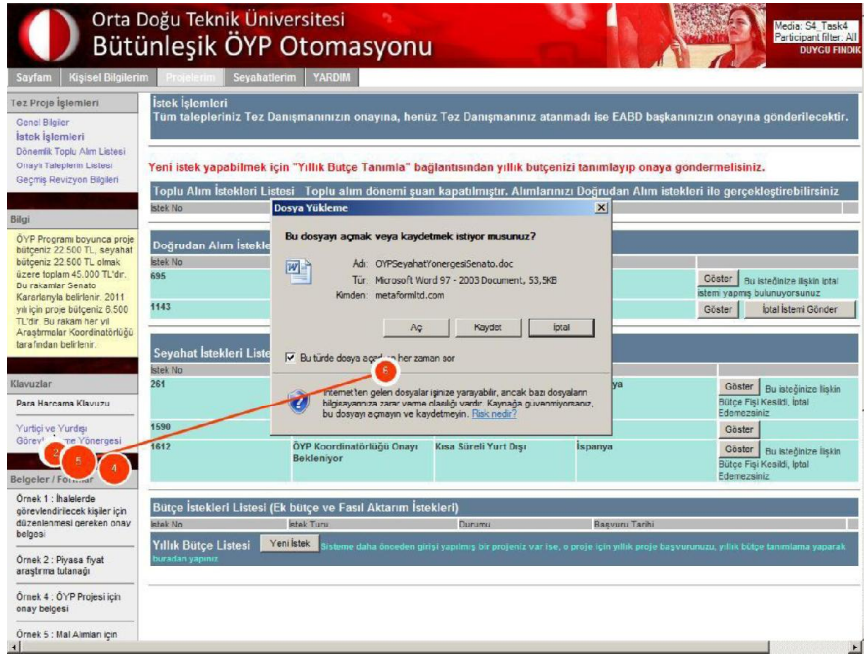
Figure 62. The Gaze Plot of the Task4 of Subject4

In the interview, subject4 stated " task4 was easy and I found it easy".

Subject5

The Figure 63 presents the Heat Map of the Task4 of Subject5. It is shown that the most intensity is in left frame. Also Figure 64 presents the Gaze Plot of the Task4 of Subject5. The number of saccades shows that the subject scanned the page. The subject focused left frame and looked at the "Belgeler/Formlar" and "Kılavuzlar" part and found the needed file.

Figure 63. The Heat Map of the Task4 of Subject5

Figure 64. The Gaze Plot of the Task4 of Subject5

After the usability test, in the interview subject 5 stated, " the task was easy. I performed it easily".

In usability test, results showed that the highest mean of total fixation duration is in Content Area, similary the highest mean of fixation count is Content Area. In other words, the subjects were more focused on content area. Also, the results showed that the students feel themselves lost and they tried perform the task by trial and error method. Also, by taking their voice record in CTA into account, the results showed that the students have no enough acconting information to fill the request form so they complete the task without being sure. Finally, the results showed that the students were lost, while they were using the menus.

After the usability test, the interview which included two parts was conducted. The first part is about tasks in usability test and the other questions are about the FDP Information Portal. In regard to the answers of the subjects, it is resulted that all subjects found the tasks easy; however, some difficulties encountered were verbalized. It was stated that system and the parts in which accounting information is

needed are complex and also they have no accounting information to fill the request form. In second question which is about the Help Menu, the results showed that nobody has used the Help menu before. The question is related to Task2 (finding the "Proje Onay Süreci" graph) because the graph is in Help Menu. In usability test, only one subject found it and stated that she guessed where she will find the graph. Moreover, in regard to the answers of third questions, all subjects except one student got help from their FDP friends or the institute officer to create either academic travel request or project request. Also, the student who does not get help from no one stated that he has enough accounting information.

In second part of the interview, the result showed that all subjects except one did not think that they reach the needed information for them on the portal. These information are about the descriptive information about accounting codes/types, and how to create request. Moreover, about the budget control on portal, the results showed that all subjects control their budget easily. Also, about organization of information on the portal, except two subjects, three subjects stated that the system and menus are complex so they feel themselves as if they lost. In the other question which is about the menus and their structures, the results indicated that all subjects except one stated found menus and their sturcture are complex. There are links which have same title and some submenus are not related to the main menu which include them. Therefore trial-error method is usually used.

4.4.1. The Usability Suggestions of FDP students about FDP Information Portal

In the interview, the subjects gave suggestions about FDP Information Portal. The suggestions were obtained from mostly the last question of the interview, it was general question about FDP Information Portal so the subjects verbalized their suggestions. Also in other questions, the subjects made some suggestions and all suggestions were combined in Table 31 that presents the suggestions and their frequencies. The detailed suggestions are in Appendix G.

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Table 31. The Suggestions about FDP Information Portal

Suggestions	Frequency
Menu and Interface Design	11
Content	4
Approval Process	3
Warning System	3
Accounting Information	3
Authority	3
Guidance	1
Reliability of content	1
Total	27

N=5

In suggestions, *Menu and Interface Design* has the highest frequency. This suggestion includes menu design, and shortcomings of menu structure. When the suggestion were mentioned, problematic issues were stated with it. The conspicuous suggestions with problematic issse are in below,

- A sub-menu and a menu have same name. It should be changed.

- Some sub-menus and links which are in left frame of the portal have same name. It should be changed.

- Documents and forms are in left frame of the portal but there should be a menu including them.

- Some menus and their sub-menus are not related to each other. Menu structure should be designed correctly.

- There are three "*Yeni İstek*" buttons and each other is related to different tasks. It should be changed.

CHAPTER 5

CONCLUSION

This chapter includes discussion, the implication for practice, and implication for further research.

5.1. Discussion

As stated before, the purpose of the study was to investigate the usability issues of FDP Information Portal in regard to the FDP students opinions. In this study, user satisfaction, usability of the FDP Information Portal were paid attention.

To investigate satisfaction levels of FDP students in terms of their genders and institute types was another purpose of the study. The levels were measured in five categories that are Overall Reaction to the System, Screen, Terminology and System Information, Learning, and System Capabilities. By taking genders into account, male students have higher satisfaction means in all categories than females have. Moreover, even though the total satisfaction mean of male students are higher than that of females, it was concluded that the difference is not statistically significant. Also, in point of lowest and highest satisfaction means, females and males have the lowest satisfaction means in same category that is *Overall Reaction to the System*, also the highest satisfaction means in same category, *Screen.* The *Screen* category contains "reading characteristics on the screen", "highlighting simplifies task", "organization of information" and "sequence of scenes". Although the results showed that both females and males are satisfied in Screen category, but in usability test it was found that there is a interface/screen and menu problems on the portal.

Similar to previous result, the students in GSNAS or GSSS have the lowest satisfaction means in *Overall Reaction to the System*; however, GSSS has the highest

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mean in *System Capabilities* category while GSNAS has the highest mean in *Screen*. Moreover, when looking at the overall satisfaction mean, the students who are registered in GSNAS have higher means in all categories than the students who are registered in GSSS. Also it was concluded that the difference is statisticially significant.

Several explanations may be offered on these findings. There might be factors affect satisfaction levels of students who are registered in different institutes that are GSNAS ans GSSS. By taking perceived computer competency levels in terms of institutes into consideration, it was concluded that GSNAS has higher perceived computer competency levels means than GSSS has. It can be said that computer level might be seen as an factor affecting to students' satisfaction level. In other words, lack of computer level can cause dissatisfied users. Moreover, Montazemi, A. (1988) found his study that there is a positive correlation between end-user computer literacy and user satisfaction in the context of small business environment. Moreover, the students in GSNAS have higher mean in terms of computer usage years and computer usage hour within a day than the students in GSSS have.

Also different culture backgrounds of institutes may be a factor that affects the satisfaction levels. In addition, it is known that GSSS and GSNAS have different types of cultures, courses, aims, visions. Because as an organization, each institute has its own characteristics, the different culture background can be acted a part in the institutes' satisfaction levels. Furthermore, it is known that GSSS studies on social sciences; while GSNAS studies on natural and applied science so it is closer to computer and technology area. This cultural differences can influenced the students' satisfaction. Also, Weber and Pliskin (1996) paid attention the organizational culture in their studies which is about effectiveness of information system and it was found that in the effective implementation of information system integration, organizational culture plays an essential role.

The other factor that affect the satisfaction level might be social psychology. In this

point, the underlying reasons should be investigated. According to Thong & Yap(1996), to explain user satisfaction problems, the social psychology literature is employed. And he continued that "theories and models from the behavioural sciences offer a sound basis for understanding the problems with conceptualization and operationalization of user satisfaction" (p.601). There is a requirement to search the user satisfaction construct' root, and figure out its relation with the behaviour, to reach a net conceptuality of user satisfaction (Thong & Yap, 1996). Furthermore, by taking the result of SUS and the interview, the similar results were seen. In SUS, the fourth lowest mean belongs to nineth item which is "I felt very confident using the system". Also, in the interview which was conducted after the usability test, all subjects except one student stated that they need help to use the system and they want their FDP friends or the institute officer to help them.

Moreover, differences in expectations and needs may be a factor that influence the satisfaction levels. Cyert and March (1963) connected the user satisfactions with satisfied their needs. They stated that if an information system supply the needs of the users, the users' satisfaction about the information system will rise. On the contrary, if the system does not ensure the required information, the users will get dissatisfied. In other words, it is significant to provide an applicable level of fit between the needs of user and expectations (Kassim, Jailani, Hairuddin, & Zamzuri, 2012). Also in the study, by taking the most negative and positive aspects of the portal into consideration which was obtained from QUIS, it can be stated that the number of negative aspects is higher than that of positive aspects. In other words, the students mentioned more the shortcomings of the portal and their needs. In negative aspects, the most frequency belongs to the *Lack of System Content and Guide* that includes lack of descriptive information about accounting codes and types. In this point, the FDP students need more descriptive information and guide to use the portal properly. Moreover, in the interview, the result showed that all subjects except one did not think that they reach the needed information for them on the portal. These information are about the descriptive information about accounting codes/types, and how to create request. Also in last question of the interview, the

students made suggestions and mentioned their expectations and needs.

The other factor might be students' trusts to the system. In this point, Baron and Kenny (1986), concluded that the relationship between user acceptance measured as ease of use, information quality and system quality and satisfaction is mediated by trust on the system. Furthermore, Kassim, Jailani, Hairuddin, and Zamzuri (2012) stated, "Building of trust is based on an individual personal feeling of security and safety, thus, it result a positive reacting attitude towards the system system is more trustworthy, users will be more satisfied" (p.417). In the study, *Unreliability in system content* was determined as the third negative aspects of portal by FDP students via QUIS. When analyzing the aspect, it is said that the system includes missing and inaccurate information. The students do not trust the system content and there is an inconsistency between system content and user manual. However, the QUIS results showed that the students in GSSS are the most satisfied in System Capabilities category that includes system reliability.

The second question of this study was related with usability of FDP Information System. In this study, the usability results in terms of genders revealed that male students found the portal more useful than female students found it. However, the means of the usability scale in terms of genders are not significant. Furthermore, the students who are registered in GSNAS found the system more useful than the students who are registered in GSSS. Also, in all items of the usability scale, GSNAS is ahead of GSSS. However, the mean differences are not statisticially significant. Both the female students and the students in GSSS have the lowest usability mean in same item, *I found the various functions in this system were well integrated*. Also similar problem was found in interview. About organization of information on the portal, except two subjects, three subjects stated that the system and menus are complex so they feel themselves as if they lost. Also in the usability suggestions that were made by the subjects, the suggestion belonging to the most frequency is *Menu and Interface Design.* This suggestion includes menu structures, sub-menu and menus relations and organizations of them. Moreover, male students have the lowest

usability mean in *I would imagine that most people would learn to use this system very quickly* item and the students in GSNAS have the lowest mean in *I found the system very cumbersome to use item*. The items emphasized that the system are complex and usage of system is not easy. Also in usability test, by taking subjects' voice into account, it is said that the most subjects feel themselves lost when they were using the system and the difficulty of system was mentioned in the interview.

The fourth question of this study was related with usability problems of FDP Information Portal. The main four task were performed by five FDP students with eye-tracking and their voices were recorded while they were performing the tasks. During the tasks some difficulties were faced, some subjects felt themselves lost. As one of the subjects stated, " I lost, I gave up the task". Similarly, the other subject felt herself lost and stated, " I do not know where I should write the needed information. I think I am in wrong page because there is not relevant button, I will try again because I think the steps I followed were correct...". The other subject verbalized her thoughts more clear and she stated, " There is a "Seyahatlerim" menu but I create a request for academic travel by using "Projelerim" menu. I'm confused why there is a "Seyahatlerim" option if I do not use it for this purpose.." Menu design problems can cause users feel themselves lost. For menu issue, Paap and Cooke (1997) stated that "Most errors in menu-driven systems occur because the meaning of the options is not clear to the user. One method of increasing the clarity is to append an expanded descriptor to each keyword or phase" (p.536).

The other difficulty encountered was lack of descriptive information about tasks on the system. The subjects did not feel themselves confident, they were confused while they were filling the request form. A subject stated, "Type of request and account code are contradictory. I'm confused that the flash disk is a computer device or an external disk" and in a similar manner, the other subject stated, "Is USB Flash disk equipment or supplies, which one is correct? Should I select which accounting code. Also, same problem was found in QUIS as the first negative aspect that is *Lack of system content and guide* of the portal. In this aspects, especially lack of descriptive

information about accounting codes/types was mentioned and also in the interview, the second most suggestion is about the content. It was stated that they need descriptive accounting information.

When designing the information system, user characteristics and abilities should be taken into account, otherwise the users are confused. The content of information system should be appropriate the users levels and skills. If detailed and descriptive information is needed, it should be placed on the system. In this point, Wagner (2002) emphasized that if the interface is designed without taking the users' ability into account, the users are confused and this reasons many problems for them to develop conceptual model correctly.

Also the intensities of subjects' fixation are in content area and left frame that is seen in Heat Map of the subjects easily. Content area includes the content of the portal and students focused this area to read the content or look over to find the answers of tasks. The left frame includes four parts that are "Tez Proje İşlemleri", "Bilgi", "Kılavuzlar" and "Belgeler/Formlar". And the sub-menus of each menu are shown in left frame. In other words, when "Projelerim" menu is selected, its submenus are shown in left frame. Therefore the subjects focused on both content area and left frame. Moreover, the saccades shows the paths that the subjects' eyes followed. It is possible to see the saccades almost every frame/area of the portal. The subjects tried to find the answers. Also these fixation and saccades results are parallel to the result of usability test by taking the subjects' voice records into account and also interview.

After usability test, interviews were conducted with the subjects. The results were the similar to the previous results. It was stated that system and the parts in which accounting information is needed are complex and also they have no accounting information to fill the request form. Therefore, all subjects except one student got help from their FDP friends or the institute officer to create either academic travel request or project request. Moreover, reaching the needed information is another problem and the needed information is about the descriptive information about

accounting codes/types, and how to create request. About organization of information on the portal, menu structure and the relation between submenus and their menus include problem and this problem causes the subjects to feel themselves lost.

Finally, the usability suggestions were created considering the subjects' answers. The suggestions that have the highest frequency were collected as *Menu and Interface Design.* As the subjects verbalized in think-aloud method, in interview they reported that menu names are not clear so they are confusing and in real life they perform their task by trial and error method.

5.2. Implication for Practice

Lack of system content and guide was selected as the first negative aspect of the portal. Students reported that in this aspect most problems are about the main task that is creating project request and academic travel request. In creating project, accounting part is problematic issue, namely in the portal there is no descriptive information about accounting codes and types. Even, existing information about them are confusing. Because the information about the accounting codes and types is related to accounting area so it could not be expected the students understand this information. The content of portal could be appropriate for the students and there could be descriptive information about accounting codes and types. In other words, the accounting information and accounting terms could be facilitated for students and the documentations about the accounting could be placed in the page that the students create a new request.

Lack of communication within the Portal was found as the second negative aspect. In this point, waiting approval for requests is problematic issue. To be accepted project or academic travel requests, the students take approval from their thesis advisor, department chair, the institute to which they are registered, and FDP office. However, in the portal there is no any warning message for the waiting approval so

this approval process can take a long time. A warning system might be created for waiting approvals so when the user logs in to the portal, the approvals might be realized easily.

Furthermore, in usability test it was found that there is a *Menu and Interface* Design problem in portal. The subjects in usability test reported that menu names are not clear, there are links that have same name so when they try to create a new request, they feel themselves lost. The system is not clear. In this point, it can be said that the menu structure might be re-controlled and their names might be designed so that the users understand meaning of the name. Also following suggestions might be applied:

- A sub-menu and a menu have same name. It might be changed.
- Some sub-menus and links which are in left frame of the portal have same name. It might be changed.
- Documents and forms are in left frame of the portal but there might be a menu including them.
- Some menus and their sub-menus are not related to each other. Menu structure might be designed correctly.
- There are three "*Yeni İstek*" buttons and each other is related to different tasks. It might be changed.

Moreover, a training about usage FDP Information Portal might be given. In this way, all question marks in FDP students' minds can be disappeared.

5.3. Implication for Further Research

To investigate the effectiveness of the FDP Information Portal, System Usability Scale (SUS) and Questionnaire for User Interface Satisfaction were conducted. The further research, the questionnaire can be designed according to characteristics of the system. Because each system has different aspects and there may be different items about the system. Also to measure the effectiveness, new dependent variables or independent variables can be needed. The effectiveness of the portal was assessed by

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its usability and the FDP students' satisfaction. Also, students attitudes toward to the computer and FDP Information system might be analyzed. Because both of them may affect the usability of the portal in terms of user opinions.

Moreover in this study, only two institutes that are Graduate School of Natural and Applied Sciences (GSNAS) and Graduate School of Social Sciences (GSSS) were taken into consideration. The further   research can be include all of the institute types. Furthermore, the users were described as FDP Students. The other users who are the FDP students' advisor, their department chair, FDP officer and institute officers were not participated in the study. The further study may include different type of users in this way, new usability problems or deficiencies can be emerged.

In 1980's, it was realized that the fail of usability testing has frequently occurred, and it has been proposed that some laboratory studies have not had some conditions with actual system and the relation of the data to life was at most extraneous and at worst distorting (Whiteside, Bennett & Holzblatt,1988). In this study eye-tracking was conducted in Human-Computer Interaction Laboratory. Eye –tracking tool was embedded in a desktop computer so the subjects came to the laboratory and use the computer the first time. In this test, the other conditions are also different such as light, environment. Different conditions or different context may affect the user behaviour or their task performance. In the further study a peripheral device that including a camera may be used for eye tracking method. Therefore, all subjects do not need to come HCI Laboratory and they perform the tasks in their on computer by using the peripheral device. The conditions may be same like in real life.

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APPENDIX A

DEMOGRAPHIC INFORMATION and COMPUTER LITERACY SCALE

SECTION I – Demographic Information

Gender : Female ☐ Male ☐

Age : 20 – 24 ☐
25 – 29 ☐
30 – 34 ☐
35 – 39 ☐

Being registered institute:
Graduate School of Social Sciences ☐
Graduate School of Natural and Applied Science ☐

SECTION II – Computer Literacy Scale

Q1. Please respond to each of the following computer-related questions by putting a tick (√) in the box at the appropriate spot with a 5-point scale. For 'Other' responses, provide a brief response.

How long have you been using computers? ………………………………...…
On average, how many hours a day you spend at the computer? ……………...

		Poor				Excellen
		1	2	3	4	5
1	I can properly turn on and shut down a computer					
2	I can start and exit a computer program					
3	I can minimize, maximize and move windows on the desktop					
4	I can perform file management including deleting and renaming files, etc.					
5	I can use a 'search' command to locate a file					
6	I can install a software program					
7	I can scan disks for viruses					
8	I can move a file from a hard drive to a USB drive					
9	I can write files onto a CD					
10	I can print a document using a printer					

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11	I can create a basic Word document					
12	I can copy, cut and paste text in a document					
13	I can change font style and size in a document					
14	I can create a basic Excel spreadsheet					
15	I can create a simple database using Access					
16	I can create a simple presentation using PowerPoint					
17	I can create a simple Web page					
18	I can send and receive attachments through e-mail messages					
19	I can search for information online using a Web search engine					
20	I can download and save files from the Web (e.g., text, graphic, PDF files)					

APPENDIX B

SYSTEM USABILITY SCALE (SUS)

SECTION III – System Usability Scale

By considering FDP Information Portal (http://oyp.metu.edu.tr), respond to each of the following system usability questions by putting a tick (√) in the box at the appropriate spot: 'Strongly Disagree','Disagree', 'Neither agree nor disagree','Agree', and 'Strongly Agree' .

	Stronglly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1. I think that I would like to use this system frequently					
2. I found the system unnecessarily complex					
3. I thought the system was easy to use					
4. I think that I would need the support of a technical person to be able to use this system					
5. I found the various functions in this system were well integrated					
6. I thought there was too much inconsistency in this system					
7. I would imagine that most people would learn to use this system very quickly					
8. I found the system very cumbersome to use					
9. I felt very confident using the system					
10. I needed to learn a lot of things before I could get going with this system					

APPENDIX C

QUESTIONNAIRE for USER INTERFACE SATISFACTION

SECTION IV – Questionnaire for User Interface Satisfaction

By considering FDP Information Portal (http://oyp.metu.edu.tr), respond to each of the following system usability questions by putting a tick (√) in the box at the appropriate spot: Each area measures the overall satisfaction with a 9-point scale.

OVERALL REACTION TO THE SOFTWARE		0	1	2	3	4	5	6	7	8	9		NA
1.	terrible											wonderful	
2.	difficult											easy	
3.	frustrating											satisfying	
4.	inadequate power											adequate power	
5.	dull											stimulating	
6.	rigid											flexible	
SCREEN		0	1	2	3	4	5	6	7	8	9		NA
7. Reading characters on the screen	hard											easy	
8. Highlighting simplifies task	not at all											very much	
9. Organization of information	confusing											very clear	
10. Sequence of screens	confusing											very clear	
TERMINOLOGY AND SYSTEM INFORMATION		0	1	2	3	4	5	6	7	8	9		NA
11. Use of terms throughout system	inconsistent											consistent	
12. Terminology related to task	never											always	
13. Position of messages on screen	inconsistent											consistent	
14. Prompts for input	confusing											clear	
15. Computer informs about its progress	never											always	
16. Error messages	unhelpful											helpful	
LEARNING		0	1	2	3	4	5	6	7	8	9		NA
17. Learning to operate the system	difficult											easy	
18. Exploring new features by trial and	difficult											easy	

		0	1	2	3	4	5	6	7	8	9		NA
error													
19. Remembering names and use of commands	difficult											easy	
20. Performing tasks is straightforward	never											always	
21. Help messages on the screen	unhelpful											helpful	
22. Supplemental reference materials	confusing											clear	
SYSTEM CAPABILITIES		0	1	2	3	4	5	6	7	8	9		NA
23. System speed	too slow											fast enough	
24. System reliability	unreliable											reliable	
25. System tends to be	noisy											quiet	
26. Correcting your mistakes	difficult											easy	
27. Designed for all levels of users	never											always	

List the most **negative** aspect(s):	List the most **positive** aspect(s):
1.	1.
2.	2.
3.	3.

APPENDIX D

TASKS of USABILITY TEST

Görevler

Aşağıdaki görevler ÖYP Bilgi Portalı'na (http://oyp.metu.edu.tr) giriş yapıldıktan sonra yapılacaktır.

1. Tez çalışmanızda veri depolamak için bir adet 4 GB Flash Diske ihtiyaç duymaktasınız, toplam 50 TL harcayarak proje isteği oluşturunuz.

2. Portal'da "Proje Onay Sürecini" gösteren grafiği/tabloyu bulunuz.

3. Bildiri sunmak amacıyla, İstanbul'da 4-7 Aralık 2013 tarihleri arasında gerçekleşecek olan Bilişim Konferansı için bir seyahat isteği oluşturunuz. Bu seyahat ÖYP destekli olup, tez danışmanınız bulunmamaktadır. Uçak gidiş-geliş 500 TL, konferans için de 1000 TL gerekmektedir.

4. Portal'da "Yurtiçi ve Yurtdışı Görevlendirme Yönergesi" kılavuzunu bulunuz.

APPENDIX E

INTERVIEW QUESTIONS

Kullanılabilirlik testi sonrası görevlerle ilgili sorular

1. Görevlerin zorluk dereceleri nelerdir? (Kolay - Normal - Zor)

   1.1. Sizi görevlerde en çok ne zorladı?

2. Yardım Menüsünü hiç kullandınız mı? Hangi amaçla?

3. Proje veya Seyahat isteği oluştururken arkadaşlarınızdan yardım alıyor musunuz? Aldınız mı?

Portal için genel Sorular

1. Portal'da size gerekli olduğunu düşündüğünüz bilgilere ulaşabiliyor musunuz? Hayır ise bu bilgiler nelerdir?

2. Portal'da ne kadar bütçeniz kaldığını kontrol ederken, terimleri, birimleri anlamakta zorlanıyor musunuz? Nasıl açıklar mısınız?

3. Portal'da bilgilerin iyi bir şekilde organize edildiğini düşünüyor musunuz? Neden, örnek verebilir misiniz?

4. Menüler arasında ya da menüler içi, mantıksal hatalar olduğunu düşünüyor musunuz? Neden, açıklar mısınız?

5. Portal'ı değiştirmek isteseniz hangi özelliğini ya da hangi parçasını değiştirirdiniz? Neden?

APPENDIX F

THE NEGATIVE ASPECTS and THE POSITIVE ASPECTS

The Negative Aspects	f
Lack of System Content and Guide	**11**
Proje ve Bütçe kalemleri sıkıntılı ve zor	
Malzeme alımında bilinmeyen çok detay var	
Teçhizat kod numaraları açık değil	
İstek işlemleri kısmı daha açıklayıcı olmalı ya da daha güzel örneklendirilmeli	
Sisteme nasıl veri girişi yapılacak, bilgilendirme çok eksik	
Projenin nasıl oluşturulacağına dair yönlendirme yok (bilgi yetersiz)	
Yeterli bilgi verilmiyor	
Seyahat bilgilerinin yanında bütçe bilgileri yok	
Kullanım için açıklayıcı dokümanlar olmalı	
Kolaylıkla web sayfası içinde yönlendirilmeli	
Çok fazla link var, bazılarının altı boş	
The Lack of Communication within the Portal	**8**
Bekleyen onaylar için uyarı sistemi	
Onay verenlere otomatik mail atmalı	
Onay için uyarı-bilgilendirme mesajı gitmeli	
Kişilere onay vermeleri için uyarı mesajı gönderilmeli	
Mail ile bilgilendirmenin olmayışı	
Onay için uyarı mesajı	
Satın alma işlemlerinin başlangıç-bitiş tarihlerini belirten e-posta,	

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süreç kaçıyor

Yıllık bütçe tanımlaması için gerekli hatırlatmanın yapılmaması

Unreliability in System Content	7

Farklı giderler farklı isimle gösteriliyor (çok can sıkıcı)

Sistemde toplu alım 2 kat almış görünüyor

Güvenilir kayıt yok

Bilgiler denetlenmiyor, güvensiz

Sistem güven vermiyor

Proje başlıkları ve tarihlerde yanlışlıklar var

Kullanım kılavuzu ile sistemin içinde tutarsızlık bulunması

Difficulty of the Approval Process	7

Herkesten (danışman, bölüm başkanı, vs.) onay almak (azaltılmalı)

Herkesten onay almak (geç ilerliyor)

Süreci yavaşlatıyor (onay beklemek),

Her işlem için onay almak, zaman kaybı

Onay prosedürü hızlı çalışmıyor

Onay süreci işleri zorlaşırdı

Bir çok aşama olması

Difficulty to Use	6

Çok hantal çalışıyor

Çoğu zamanda çalışmıyor

Hantal, user friendly değil

Complex, yeni kullanıcılar için yardımcı değil

Portal gereksiz derecede karışık

Karmaşık, Kullanıcı dostu değil

Design Problems	5
Portal estetik ve user friendly değil	
Menü arayüzü kullanıcı dostu değil	
Portalın tasarımı uygun elverişli değil	
Görseller üzerinden daha basic kullanım ortamı yaratılabilir	
Kullanıcı dostu değil, görselliği yetersiz	
Restrictions of authority	5
Yapılan hataların kolay düzeltilememesi	
Yanlış istek ya da kullanılmayan istekler (taslaklar) silinemiyor	
Yapılan hatalar kolaylıkla düzeltilmiyor	
İstekler hangi süreçte olursa olsun iptal edilebilmeli	
Kullanıcının bilgi güncellemesi yapamaması	
Giving Error	2
Hata veriyor, uyarı vermiyor (hatanın ne oluğu bilinmiyor)	
Çok sık hata veriyor	
Update Issues	2
Bilgiler hemen güncellenmiyor	
Sistem güncellenmesi sıkıntılı	
Automatic intro Video	2
Girişte sesle eğitim veren karakter itici	
Her açtığında başlayan konuşma	
Total	55

The Positive Aspects	f
Easy access to the Portal	11

Belgelere ulaşmada kolaylık

Online olarak seyahat proje bilgilerine ulaşmak

Her an istediğimiz yerden erişebiliyoruz bilgilere

Satın alma işlemlerinde kimseye bağlı olmadan takip etme şansımız oluyor
Projeleri ve başvuruları internetten takip etmek

Online bir portal olması

Takip etme imkanı

Tüm bilgilerin takip ediliyor olması,

Şimdiye kadar yapılan işlerin takip edilmesi

Sürecin kolaylıkla takip edilebilmesi

İşlemin hangi aşamada olduğunu görmek

Seeing the information of all expenditure	11

Bilgileri derli toplu görmek

Seyahat ve projelerin düzenli tutulması

Tüm seyahat proje işlerinin görülebiliyor olması

Proje bilgileri masraflar vs bilgi görmek iyi

Geçmişte yapılan seyahat proje hakkında bilgi

Geçmiş hakkında bilgi vermesi

Geçmişe yönelik faaliyetler var

Yapılan harcamaları görme

Yapılan harcamaların kayıtlı olması

Öğrenciye ait bilgilerin tutulması

Numerik bilgiye ulaşmak

Others	5
Öğretici	
Hızlı olması	
Bütçe kullanımını hızlandırıyor	
Kullanımı basit	
Bir çok işlemi portaldan yapabilmek	
Being Open to Improvement	2
Geliştirilmeye açık olması	
Çağımız gereklerine uyum için gerekli	
Total	28

APPENDIX G

THE SUGGESTIONS ABOUT FDP INFORMATION PORTAL

Suggestions	Frequency
Menu and Interface Design	11
Belgelerin, formların sadece bir yerde bulunması	
Alt sekmelerin tekrar tasarlanması	
Menü yapısındaki karışıklığın giderilmesi	
Belgeler bölümünün daha iyi bir yere alınması	
İstek işlemleri için açıklayıcı menu olması	
İstek işlemleri için adımların açık olması	
Bütçe kullanımı için açıklayıcı menu bulunması	
Birbirine karışan buton isimlerinin ve kavramların değiştirilmesi	
Yeni istek oluşturma değişen kavram, kafa karıştırıyor	
Belgelerde interaktivite olması	
Buton tasarımının değiştirilmesi	
Content	4
Harcanmış / Harcanmamış tüm bütçeyi görmek	
Formların güncellenmesi	
Her bir projenin toplanmış halini görmek	
Detaylı bütçe görmek	
Approval Process	3
Onay sürecinin hızlı olması gerektiği	
Onay sürecinin hızlı bir şekilde yapılması gerektiği	
Onay sürecinin kolay bir şekilde tamamlanması gerektiği	
Warning System	3
Veri girişinde, bütçe aşıldığında sistemin uyarı vermesi	
Yanlış veya Geçersiz veri girildiğinde sistemin uyarı vermesi	
İşlemlerin gerçekleşmemesi nedenini gösteren uyarı verilmesi	

Accounting Information	3
Alınacak malzemenin kodunun detaylı verilmesi	
Kalem tipi, hesap kodu bilgilerinin açıklayıcı olması	
Muhasebe kodlarında açıklayıcı olunması	
Authority	3
Kullanıcı adı/ şifreyi belirleme yetkisi	
Yıllık bütçeyi iptal etme yetkisi	
Yıllık bütçede kalemler arası para transferi yapma yetkisi	
Guidance	1
Yönlendirmenin gerekliliği	
Reliability of content	1
Harcama bilgilerinin doğru girilmesi	
Total	27

N=5

THE INDEPENDENT SAMPLE t-TEST ASSUMPTIONS

The Satisfaction Means in terms of Genders

Assumption 1: The Test Variable is Normally Distributed in Each of the Two Populations.

H_0 : FDP Students' Satisfaction Means fits the normal the distribution.

H_a : FDP Students' Satisfaction Means does not fit the normal the distribution

Table 32 presents test of normality, namely Kolmogorov-Smirnov Test and the Shapiro-Wilk Test. In this study, The Shapiro-Wilk Test which is handled samples up to n=2000 is taken into consideration because of study sample size (N=100).

Table 32. Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Satisfaction Levels	Female	.07	57	.20[*]	.99	57	.97
	Male	.08	43	.20[*]	.98	43	.56

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

For female students, significant value (p=.97) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05). Similarly, for male students, significant value (p=.56) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05). The alternative hypothesis *(H$_a$)* is rejected. It is concluded that FDP Students' Satisfaction Means fits the normal the distribution.

Assumption 2: The Variances of the Normally Distributed Test Variable for the Population are Equal. *(m presents males, f presents females).*

H_0 : $\sigma^2_m = \sigma^2_f$ (There is no significant variance difference between the male and female FDP students' satisfaction means.)

H_a : $\sigma^2_m \neq \sigma^2_f$ (There is a significant variance difference between the male and female FDP students' satisfaction means.)

In Table 9, significant value (p=.49) of Levene's Test for Equality of Variance is greater than coefficient alpha (α=.05), (p > .05). The alternative hypothesis *(Hₐ)* is rejected. It is concluded that there is no significant variance difference between the male and female FDP students' satisfaction means.

After checking the assumptions, the independent samples t test was conducted. There are two main hypothesis in below:

H_0 : $\mu_m - \mu_f = 0$ or $\mu_m = \mu_f$ (There is no significant mean difference between the male and female FDP students' satisfaction means.)

H_a : $\mu_m - \mu_f \neq 0$ or $\mu_m \neq \mu_f$ (There is a significant mean difference between the male and female FDP students' satisfaction means.)

For main hypothesis, significant value (p=.26) of t-test for Equality of Means is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(Hₐ)* is rejected. It was concluded that there is no significant mean difference between the males' satisfaction means (M=5.33) and females' satisfaction means (M=4.91); *t*(98)= -1.15, p=0.26

The Satisfaction Means in terms of Institute Types

Assumption 1: The Test Variable is Normally Distributed in Each of the Two Populations.

H_0 : FDP Students Satisfaction Means fits the normal the distribution.

H_a : FDP Students Satisfaction Means does not fit the normal the distribution

Table 33. Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Satisfaction Levels	GSSS	.05	52	.20[*]	.99	52	.96
	GSNAS	.08	48	.20[*]	.98	48	.69

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

For students registered in GSSS, significant value (p=.96) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05), (p >.05). Similarly, for students registered in GSNAS, significant value (p=.69) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(H$_a$)* is rejected. It is concluded that FDP Students Satisfaction Means fits the normal the distribution.

Assumption 2: The Variances of the Normally Distributed Test Variable for the Population are Equal. *(1 presents GSSS, 2 presents GSNAS)*

H_0 : $\sigma^2_1 = \sigma^2_2$ (There is no significant variance difference between the satisfaction means of students who are registered in GSSS or GSNAS.)

H_a : $\sigma^2_1 \neq \sigma^2_2$ (There is a significant variance difference between the satisfaction means of students who are registered in GSSS or GSNAS.)

In Table 11, significant value (p=.24) of Levene's Test for Equality of Variance is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(Ha)* is rejected. It is concluded that there is no significant variance difference between the students who are registered in GSSS or GSNAS.

After checking the assumptions, the independent samples t test was conducted. There are two main hypothesis in below:

H_0 : μ_1-μ_2=0   or μ_1 = μ_2 (There is no significant mean difference between the students who are registered in GSSS or GSNAS.

H_a : μ_1-μ_2≠0 or μ_1≠ μ_2 (There is a significant mean difference between the students who are registered in GSSS or GSNAS.

For main hypothesis, significant value (p=.04) of t-test for Equality of Means is smaller than coefficient alpha (α=.05), (p < .05). The null hypothesis *(H0)* is rejected. It was concluded that there is a significant mean difference between the students who are registered in GSSS (M=4.74) or GSNAS (M=5.46); *t*(98)=2.00, p=0.04.

The FDP Information Portal' Usefulness Means in terms of Genders

Assumption 1: The Test Variable is Normally Distributed in Each of the Two Populations.

H_0 : FDP Students Usefulness Score fits the normal the distribution.
H_a : FDP Students Usefulness Score does not fit the normal the distribution

Table 34 presents test of normality, namely Kolmogorov-Smirnov Test and the Shapiro-Wilk Test. In this study, The Shapiro-Wilk Test is taken into consideration. It is handled samples up to n=2000, in this study sample is 100.

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Table 34. Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Usability Total	Female	.08	57	.20[*]	.98	57	.44
	Male	.09	43	.20[*]	.97	43	.35

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

For female students, significant value (p=.44) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05), (p >.05). Similarly, for male students, significant value (p=.35) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(Ha)* is rejected. It is concluded that FDP Students Usefulness Score fits the normal the distribution.

Assumption 2: The Variances of the Normally Distributed Test Variable for the Population are Equal. *(m presents males, f presents females).*

H_0 : $\sigma^2_m = \sigma^2_f$ (There is no significant variance difference between the male and female FDP students' usefulness scores.)

H_a : $\sigma^2_m \neq \sigma^2_f$ (There is a significant variance difference between the male and female FDP students' usefulness scores.)

In Table 14, significant value (p=.80) of Levene's Test for Equality of Variance is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(Ha)* is rejected. It is concluded that there is no significant variance difference between the male and female FDP students' usefulness scores.

After checking the assumptions, the independent samples t test was conducted. There are two main hypothesis in below:

H_0 : μ_m - μ_f =0 or μ_m = μ_f (There is no significant mean difference between the male and female FDP students' usefulness scores.)

H_a : μ_m - μ_f $\neq 0$ or $\mu_m \neq \mu_f$ (There is a significant mean difference between the male and female FDP students' usefulness scores.)

For main hypothesis, significant value (p=.18) of t-test for Equality of Means is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(H$_a$)* is rejected. It was concluded that there is no significant mean difference between the male (M=53.43) and female (M=48.99) FDP students' usefulness scores, *t*(98)= -1.36, p=0.18.

The FDP Information Portal' Usefulness Means in terms of Institute Types

Assumption 1: The Test Variable is Normally Distributed in Each of the Two Populations.

H_0 : FDP Students Usefulness Score fits the normal the distribution.
H_a : FDP Students Usefulness Score does not fit the normal the distribution

Table 35 presents test of normality, namely Kolmogorov-Smirnov Test and the Shapiro-Wilk Test. In this study, The Shapiro-Wilk Test is taken into consideration. It is handled samples up to n=2000, in this study sample is 100.

Table 35. Test of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Usability Total	GSNAS	.11	48	.18	.97	48	.33
	GSSS	.10	52	.20[*]	.96	52	.07

a. Lilliefors Significance Correction
*. This is a lower bound of the true significance.

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For GSNAS, significant value (p=.33) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05), (p >.05). Similarly, for GSSS, significant value (p=.07) of Shapiro-Wilk Test is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(H$_a$)* is rejected. It is concluded that FDP Students Usefulness Score fits the normal the distribution.

Assumption 2: The Variances of the Normally Distributed Test Variable for the Population are Equal. *(1 presents GSSS, 2 presents GSNAS)*

H_0 : $\sigma^2_1 = \sigma^2_2$ (There is no significant variance difference between the usability scores of students who are registered in GSSS or GSNAS.)

H_a : $\sigma^2_1 \neq \sigma^2_2$ (There is a significant variance difference between the usability scores of students who are registered in GSSS or GSNAS.)

In Table 16, significant value (p=.25) of Levene's Test for Equality of Variance is greater than coefficient alpha (α=.05), (p >.05). The alternative hypothesis *(H$_a$)* is rejected. It is concluded that there is no significant variance difference between the usability scores of students who are registered in GSSS or GSNAS.

After checking the assumptions, the independent samples t test was conducted. There are two main hypothesis in below: *(1 presents GSSS, 2 presents GSNAS)*

H_0 : $\mu_1 - \mu_2 = 0$ or $\mu_1 = \mu_2$ (There is no significant mean difference between the usability scores of students who are registered in GSSS or GSNAS.

H_a : $\mu_1 - \mu_2 \neq 0$ or $\mu_1 \neq \mu_2$ (There is a significant mean difference between the usability scores of students who are registered in GSSS or GSNAS.

For main hypothesis, significant value (p=.075) of t-test for Equality of Means is greater than coefficient alpha (α=.05), (p > .05). The alternative hypothesis *(H$_a$)* is rejected. It was concluded that there is no significant mean difference between the usability score of students who are registered in GSSS (M=48.13) or GSNAS (M=53.91); t(98)=1.802, p=0.075.