THE EFFECT OF DESIGN ON E-LEARNING ENVIRONMENTS

FULYA ERTÜR ALKAN

JANUARY, 2021

THE EFFECT OF DESIGN ON E-LEARNING ENVIRONMENTS

BY

FULYA ERTÜR ALKAN

DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

IN

VISUAL COMMUNICATION DESIGN

YEDİTEPE UNIVERSITY

JANUARY, 2021

PLAGIARISM

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Date : 11.01.2021

Name/Surname: Fulya Ertür Alkan

Signature :

ABSTRACT

Electronic learning (e-learning) applications are designed to deliver knowledge, information sharing and to support users for teaching and learning new systems and/or methods of doing tasks. Accordingly, e-learning is a subject of human computer interaction (HCI) field, as the field interested in the interaction between human and computer, as well as designing, evaluating and implementing interactive technologies. By using computers and/or mobile devices, learning contents are aimed to be delivered in an effective and efficient way. The effectiveness and efficiency of e-learning applications are fed from the content but as well as their success depends upon basic usability principles. The usability success can be observed and evaluated by user experiences on the related content after the user's interaction with interface of e-learning system.

In this research, the results of a usability evaluation of graphical user interface (GUI) of an e-learning content has been presented. The researcher, aimed to work with adult learners/users and workplace e-learning content. Appropriate use of usability evaluation methods according is an important aspect of this report. End-users experienced an asynchronous e-learning content according to given scenarios, the content practiced in the learning management system (LMS) platform called as SAP SuccessFactors. The researcher gives recommendations for the improvement of effective e-learning interface design. Moreover, the researcher discusses the areas of e-learning interface design where future could be more beneficial to adult learners.

Key words: Usability evaluation, e-learning, workplace learning, GUI, HCI, graphical user interface, human computer interaction

ÖZET

Elektronik öğrenme (e-öğrenme) uygulamaları bir bilginin sunulması, paylaşımı ve kullanıcılara yeni bir sistem ve/veya yöntemi öğretme ve öğrenmeleri konusunda desteklemek amacıyla tasarlanmışlardır. E-öğrenme, paralel olarak, insan ve bilgisayar arasındaki etkileşim ile bu etkileşimi konu alan teknolojilerin tasarımı, değerlendirilmesi ve uygulanmasıyla ilgilendiği için insan-bilgisayar etkileşiminin (İBE) de konusudur. Bilgisayarlar ve/veya mobil cihazlar kullanılarak eğitim içeriklerinin etkili ve verimli bir şekilde iletilmesi amaçlanmaktadır. Kullanılabilirlik başarısı, kullanıcının e-öğrenme sistem arayüzü üzerinde e-öğrenme içeriği ile edinilen kullanıcı deneyimleri sonucunda gözlemlenebilir ve değerlendirilebilir.

Bu araştırmada, bir e-öğrenme içeriğinin grafiksel kullanıcı arayüzü (GKA) kullanılabilirlik değerlendirmesinin sonuçları sunulmuştur. Araştırmacı, yetişkin öğrenenler/kullanıcılar ve işyeri öğrenme içeriği ile çalışmıştır. Kullanılabilirlik değerlendirme yöntemlerinin uygun şekilde kullanılması bu raporun önemli bir yönüdür. Son kullanıcılar, SAP SuccessFactors olarak adlandırılan öğrenme yönetim sistemi (ÖYS) platformunda bulunan asenkron bir e-öğrenme içeriğini deneyimlemiştir. Araştırmacı, etkili e-öğrenme arayüz tasarımının iyileştirilmesi için önerilerde bulunmaktadır. Ayrıca araştırmacı, yetişkin öğrenenler için gelecekte daha faydalı olabilecek e-öğrenme arayüzlerinin tasarımı konusunu tartışmaktadır.

Anahtar kelimeler: Kullanılabilirlik değerlendirmesi, e-öğrenme, işyeri öğrenmesi, GKA, IBE, grafiksel kullanıcı arayüzü, insan bilgisayar etkileşimi

To my past ten years

ACKNOWLEDGMENTS

The author wishes to express her deepest gratitude to her supervisor Associate Prof. Dr. Demet Karapınar for their patience, guidance, encouragement and feedback throughout the research.

Additionally thanks to the collaborators who provided the data used in this thesis.

TABLE OF CONTENTS

PLAGIARISM ..... **i**
ABSTRACT ..... **ii**
ÖZET ..... **iii**
ACKNOWLEDGMENTS ..... **v**
LIST OF TABLES ..... **viii**
LIST OF FIGURES ..... **ix**
1. INTRODUCTION **1**
1.1. Background 1
1.2. Objectives 2
1.3. Research Questions 2
2. LITERATURE REVIEW **4**
2.1. E-learning and E-learning Types 4
2.1.1. Asynchronous 5
2.1.2. Synchronous 7
2.2. The Concept of Usability 8
2.3. Graphical User Interface (GUI) Design 11
2.3.1. The effect of the interface design on usability and aesthetics 12
2.3.1.1. Composition 13
2.3.1.2. Typography 14
2.3.1.3. Colour 16
2.3.1.4. Icons and Images 20
2.3.1.5. Navigation 22
3. RESEARCH METHODOLOGY **24**
3.1. Data Collection 24
3.1.1. Usability Testing 24
3.1.2. Moderated Tasks Tests and Structured Questionnaire 27
3.1.3. Observation and Semi-Structured Interview 27
3.2. Method of Data Analyses 29
3.2.1. Qualitative Data Analysis 29
3.2.2. Conversational Analysis 30
3.3. Participants 31
3.3.1. Information about Participants 31
3.3.2. Selection of Participants 33

3.4. Task and Implementation 34
4. RESULTS..... 43
4.1. Task and Implementation 43
4.2. Structured Questionnaire 48
5. DISCUSSIONS 52
5.1. Limitations and Recommendations 55

LIST OF TABLES

Table 1	The Table of Coded Key Words	31
Table 2	The Participants of the Usability Test	32
Table 3	Usability Test Questionnaire	41
Table 4	Task Completion Time and Success/Fail	46
Table 5	Statistics of Usability Testing Questionnaire Results	48
Table 6	Usability Test Average Results According to Base Subjects by Experience of the Users	49

LIST OF FIGURES

Figure 1	Example to e-learning page interface design - Visually appealing	13
Figure 2	Example to e-learning page interface design – Typography 1	15
Figure 3	Example to e-learning page interface design – Typography 2	15
Figure 4	Example to good designed e-learning page interface – Colour	17
Figure 5	Example to e-learning page interface – Colour-blindness 1	18
Figure 6	Example to e-learning page interface – Colour-blindness 2	18
Figure 7	Example to e-learning page interface – Corporate identity and focal point	19
Figure 8	Corporate colour palette	19
Figure 9	Examples of ‘house (home page)’ icons in variety of designs	20
Figure 10	Play and pause icons	21
Figure 11	Example to e-learning page interface – Navigation	22
Figure 12	The basic components of a usability test	25
Figure 13	The Wheel model of the design process	25
Figure 14	Adelman and Riedel classification of usability methods	26
Figure 15	The entrance page of the course content	34
Figure 16	The second page of the course content	35
Figure 17	The third page of the course content	*35*
Figure 18	The home page of the course content	36
Figure 19	The icons used in the home page	*37*
Figure 20	The page of the course content leaded by the heading ‘Short Break’	38
Figure 21	The next of the course content leaded by the heading ‘Short Break’	38
Figure 22	Usability testing scenario steps	40
Figure 23	Turkish version fonts view of the e-learning content interface	45
Figure 24	Time spent on tasks by testers	47

Figure 25 Medians comparison of the questionnaire results 50

1. INTRODUCTION

1.1. Background

Designing an electronic learning (also known as e-learning) is a subject of art and as well as science, but in this research the focus on the user interface design of e-learnings, out of content and educational content anxiety. Finding out the success of interface design highly related with evaluation of usability of e-learning applications. Since Squires and Preece (1996) mentioned about researchers neglected the implication of usability features of an educational applications, there appeared many researches in the area, the subject of HCI has evolved in years. The use of digital technology now cover a large place in our lives, and HCI has created a whole raft of descriptions and models that tell us what we use it for. With the technological changes HCI research has changed irrevocably. For the research, which the application was made had been selected as a workplace e-learning content. The content belongs to the company of Bertelsmann which is located in Turkey. The application was implemented to the employees of the company, who has an access to the content as well, the researcher work there.

In workplace e-learning content design, the aim can be more likely providing work-related information and skills and increasing worker's knowledge. This purposes, can cause an ignorance of designing user-friendly graphical user interfaces. Though, there are quite a few sources about workplace e-learning. In this research our one of the main purpose to add a source e-learning interface design research in the area of workplace learning. There is a growing body of researchers from HCI who think that learner-centred design is more than just applying design methods with

learners as users (Brna & Cox, 1998) HCI is a discipline concerned with the design of technological artefacts that are effective, efficient and satisfying to use. In short, HCI takes a user-centred design approach to design.

In this research, it is suggested that the design of an interface for an e-learning program should be determined by how people learn and the tasks need to perform in the program. This is in contrast to other approaches which view the interface design process as separate from the learning design. In this paper, an approach has been described to e-learning interface design that focuses on the goals, audience, and learning, and explored examples that demonstrate the success of this approach.

1.2. Objectives

The main goal of the thesis is to evaluate the usability of a workplace e-learning content. The thesis hopes to achieve the two following objectives:

1. Observing key features and factors which an effect the usability of e-learning user interface by using learning management system (LMS)
2. Finding out the expectations on design of e-learning related with e-learning system experience

1.3. Research Questions

The main questions for the thesis study are:

1. What is the relationship between experience in an e-learning expectations in user interface design?

2. What is the relationship between the elements of effective e-learning design and the user's system usage time and their expectations from graphical user interface design?

1.4. Statement of Research Problem

The purpose of this research is to get a comprehensive assessment of interface design of an e-learning content in use, as experienced by its users. Initially, the researcher will compare the relation between previous e-learning experiences and design expectations from the content. The expected outcomes of this research will guide the designers who design asynchronous e-learning content in the area of workplace learning and the learning content appeals to adult users. Furthermore, after concluding the results, the methods for measuring usability of e-learning contents may be improved which could be beneficial for new products and further improvement of existing content. On the basis of results, the researcher aims to draw conclusion about the usability of content and give recommendations for improvement of the design of the content.

2. LITERATURE REVIEW

2.1. E-learning and E-learning Types

The difficulty in explaining the concept of electronic learning (e-learning) is that finding different definition in each source and it is noticeable as a hallmark of these definitions is the certainty of technology usage. In the first instance, Fallon and Brown (2016) mentions about e-learning's subsumption of any type of learning that is delivered electronically, but in broader coverage they explain it as "any learning, training or education that is facilitated by the use of well-known and proven computer technologies". E-learning is the process of gaining knowledge through the support of computers via the internet (Wang, 2017), extranet or intranet (Mealy and Loller, 2000) satellite TV, and CD-ROM with multimedia capabilities (ISP, 2004) to help individual development. It is a combination of administration and delivery of the content via computer, networked and web-based technology (Pollard, 2001). Pachler and Daly (2011) defined e-learning as "learning facilitated and supported through the use of information and communications technology". Maltz, Deblois and The EDUCAUSE Current Issues Committee (2005) claims that 'e-learning' is applicable in different perspectives like; hybrid, distributed, also online-distance learning. Arkorful and Abaidoo (2015) refer to the term of 'e-learning' as the use of information and communication technologies enable the access to online learning resources.

In the research, the concept of e-learning was discussed as online and the subject e-learning content has chosen as self-paced e-learning tool. Aforementioned, 'self-paced learning', also known as individualized learning, is a learning that directed

by the individual to meet personal learning needs (Soyemi, Ogunyunka & Soyemi, 2012). For self-paced e-learning tools, a good user-interface can increase the learner's motivation to learn by providing them with controls, displays and information elements that keep them interested, help them find out where they are, and ultimately aid them in the complex process of taking information out and integrating it into their own conceptual knowledge-base (Mendez, Lorendzo, Acosta, Torres, & Gonzalez, 2006). According to Crowther, Keller, and Waddoups (2004) poor interface design in education is more important than in business and it disrupts the user's overall motivation. The motivation is highly related with learning performance and the interactivity between the student and the interface has been considered as the most important aspect in recent studies on how to improve the quality of education through e-learning (Chou, 2003). Also, Barolli, Koyama, Duressi, and De Marco (2006) claim in their research that, only 30% of users could complete an e-learning course as because the interface was poorly designed.

2.1.1. Asynchronous

E-learning technology has the potential to facilitate higher order learning with text-based asynchronous communication technologies (Kanuka & Rourke, 2008) On the contrary of synchronous e-learning, asynchronous e-learning provides an environment in which learners are not able to communicate directly with other learners and receive information simultaneously, and do not need to be online at the same time (Hrastinski, 2007). Asynchronous e-learning is commonly offered on a CD-ROM, and/or it is web-based version of computer-based training. Course content is open access twenty-four hours per day and all the week, and accessible from any computer or device connected to the Internet or to Intranet of the organisation (Fallon

& Brown, 2016), Mayadas (1997) basically explained it as “an interactive learning community that is not limited by time, place or the constraints of a classroom”. Asynchronous e-learning occurs when learners begin and complete a training course at different times; they are responsible with their own learning and self-instruction, directly interact with the computer to proceed through the course (Carliner, 2004) There are many methods can be used for feedback; like email, direct messaging, bulletin boards and weblogs which are not real time (Jethro, Grace & Thomas, 2012). The learners would decide their own learning plan so it is flexible e-learning, although there can be specific deadlines to complete content or/and assignments. As well as interaction is flexible, the learners communicate via forums or surveys. Asynchronous e-learning is more preferred during workplace learning as it is a kind of method for learners who have erratic schedules and people who have good self-discipline (Pollard & Hillage, 2001). As we mention about workplace e-learning, the assumption of self-discipline existence will be obtained because of the awareness level of adult learners, though this can be another argument of another research.

The elements of the content of an asynchronous e-learning courseware is typically a combination of explanatory texts, animations, motionless images, sounds and videos (Fallon & Brown, 2016, p. 5) although sometimes there exist only two of the elements. Typically such courseware is monitored and managed by software systems, known as LMS, what is abbreviation of ‘learning management system’ in order to enhance learning in a variety of environments. An LMS, provides an automated mechanism for delivering course content and tracking learner’s progress, they allow users to view multimedia lectures, download and upload learning materials, communicate with the lecturers and each other in learning communities,

take online quizzes and submit assignments (Kakasevski, Mihajlov, Arsenovski, & Chungurski, 2008). LMSs either be cloud-based and open sourced.

2.1.2. Synchronous

The distinctive aspect of classroom learning is physical meeting, for e-learning we are not able to mention the existence of a classroom environment, but synchronous e-learning renders possible to be in an interaction. “Synchronous e-learning is live, real-time, facilitated instruction and learning-oriented interaction” (Shahabadi & Uplane, 2015). For Khan (2006), it is “interact of participants with an instructor via the Web in real time”. Synchronous e- learning, usually supported by the mediums like videoconferencing, teleconferencing and/or chat (Hrastinski, 2008). The method can be effective on the teams that wish to support information progress (Carr, Cox, Eden, & Hanslo, 2004). The communication can be handled healthies with synchronous e-learning (Chou, 2002) as the feedback is less effective if it is not real time and delayed (Tuovinen, 2000). As well as for Hrastinski, Keller and Carlsson (2010) synchronous e-learning is “often have a sense of excitement and spontaneity that is not present with delayed interaction”. In synchronous type of e-learnings, the classes happen in real time, they are required login times and often with a set schedule. Synchronous e-learning provides less flexibility than asynchronous e-learning although still the participation can be performed anywhere - as long as certain conditions are met; e.g. healthy internet connection, a quiet environment – but without freedom of schedule planning.

2.2. The Concept of Usability

1842 is the year of the term ‘usability’ used in the literature according to Shackel (1984). In their paper, Bevan, Kirakowski and Maissel (1991) put forward that as a term, ‘usability’ was begun to use in early 1980s in order to eliminate the ambiguity of the term ‘usability’ instead of ‘user friendly’. In Human Computer Interaction (HCI), usability is remarkably important and it is a process also called user-centred design and it is used in everyday language. Usability is the ease with which a person can accomplish a given task with a product and how people use a product. It refers to methods for improving ease-of-use during the design process and it is a quality attribute that assesses how much user interfaces meet user needs.

In retrospect from today, there are variety of definitions for usability from different angles. We can mention about usability if an interactive product is easy to learn, effective to use, optimizing interactions and from the user’s perspective, the usage is enjoyable (Preece, Sharp & Rogers, 2015). Preece and others (2015) sums up usability into the following goals:

- Effective to use (Effective)
- Efficient to use (Efficiency)
- Safe to use (Safety)
- Having good utility (Utility)
- Easy to learn (Learnability)
- Easy to remember how to use (Memorability)

Reiss (2012) relates usability with situational needs and claims that the quality of the usability is affected by satisfaction with the experience:

> Usability deals with an individual's ability to accomplish specific tasks or achieve broader goals while 'using' whatever it is you are investigating, improving, or designing—including services that don't even involve a 'thing' like a door knob or web page.

Basically, usability measures interface quality and evaluating usability is an essential part of the system development process (Dillon, 2001).

According to International Standards Organization (ISO) standard for software qualities (ISO 1991):

> "a set of attributes of software which bear on the effort needed for use and on the individual assessment of such use ..."

The proposed ISO ergonomics definition (Brooke et al 1990):

> "the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in a particular environment".

Eason's (1988) usability approach is ease-of-use oriented:

> "the degree to which users are able to use the system with the skills, knowledge, stereotypes and experience they can bring to bear"

In 2015, ISO 9241 was revised after 17 years and the concept of use of the World Wide Web has become more widespread. ISO 9241 – 11 (2015) defines usability with three main aspects:

- Effectiveness: Expresses to what extent users are able to accomplish the tasks expected to do using the application.

- Efficiency: In how long the user does the specified tasks or in what ways they do the tasks?
- Satisfaction: User's feelings that occur when using applications and refers to the measure of opinions

Usability is the most important concept of HCI (Çağıltay, 2018). In the area of HCI tries to explain usability with three main headings:

Semantic

In our daily actions we use the term ‘usable’ during our interaction experiences with technology. The terms like ‘easy to use’, ‘user-friendly’, ‘ease of learning’ are equated to usability (Dillon, 2001). Semantic approach is a kind of definition for commercial use, this kind of usage depends on the user and their experiences. From the perspective of HCI expert, there needed a certain definition of usability that, is not variable among different circumstances; if there, it needed to be stated a meaningful and a definition does not depend on person to person (Çağıltay, 2018, p. 95).

Feature based

Usability is equated to the user interface. Presence or absence of the features in a content like; windows, menus, colours, icons or pointing devices determine usability. Design guidelines are created to conduct specific design elements to provide ease to use, but following the bullets in the guidelines do not assure the usability of the interface.

Operational

The term is defined in terms of performance and affective levels manifest by users for certain tasks and environmental scenarios (Dillon, 2001). In addition to the definitions are made earlier under the main heading 'The Concept of Usability', from the operational approach a product's usability is can be explained on base of five core qualities according to Nielsen (2012):

- Learnability: How easy users accomplish their basic tasks the first time they encounter the design.
- Efficiency: How quickly can users perform a task using the interface of the system?
- Memorability: How easy is to memorize how to use the interface of the system and how easily users can reuse the system after a break?
- Errors: How many errors do users make using the interface of the system and how serious are these errors?
- Satisfaction: How do users like using the system's interface?

A user can find a product aesthetically nice but, it will not guarantee that it would be the product they needed. Accordingly, all the approaches should be considered in accordance with the researchers' needs.

2.3. Graphical User Interface (GUI) Design

A graphical user interface (GUI) is a type of user interface or system through which users interact with electronic devices via visual indicators like icons, images etc. It allows users to perform tasks on their computers (also mobile devices like tablets, mobile phones etc.) with the help of graphical controls and symbolic images rather than text command systems. To provide better user experiences those interfaces

have to be improved. At first there needed to concentrate on the graphical user interface: ease of use, functionality and aesthetics are the most important criteria for a good user experience. Many technological innovations rely upon user-interface design. A good interfaced system must be easy to use (Liang, 1987).

Improving the interaction between computer and users is the main goal of HCI. This interaction is also a subject of GUIs and a successful interface design will definitely facilitate the interaction between users and computers. Menus, icons and touch screens are GUI features and they specifically aimed to enhance the ease of use and usefulness of different functions of the system. Interface design is all about selecting the right interface elements for the task the user is trying to accomplish and arranging them on the screen in a way that will be readily understood and easily used. GUIs are interaction based, and they are developed that, users recognize commands by seeing the icons and still they have remember what each thing on the screen actually means. When using GUIs, users do mistakes but they can recognize the problem immediately and correct as it is obvious and they are undoable (Mathis, 2011).

2.3.1. The effect of the interface design on usability and aesthetics

Aesthetics are influential in how willingly, how comfortably and how efficiently humans interact with objects, devices, idea and systems. The distribution of elements (includes buttons, text, textbox etc.) and the use of colour on the web pages. The selected Graphic User Interface Design principles from aesthetic theories are listed as follow:

2.3.1.1. Composition

In the research, the composition has considered as a complete appearance of the page components. Although here mentioned about the elements separately, we intent to evaluate design elements as a whole and observe how it feels to user. Therefore, here the layout is the basic component of the composition. Layout is the placement, sizing, spacing, and emphasis of user interface elements and content within a page (McKay, 2013), basically it is a representation of interface elements with a specific and detailed graphical look and feel (Hartson & Pyla, 2012). A good layout design should be easy to understand (Reiss, 2012) and should draw user's attention to a page's focal point. It should look aesthetically delightful,

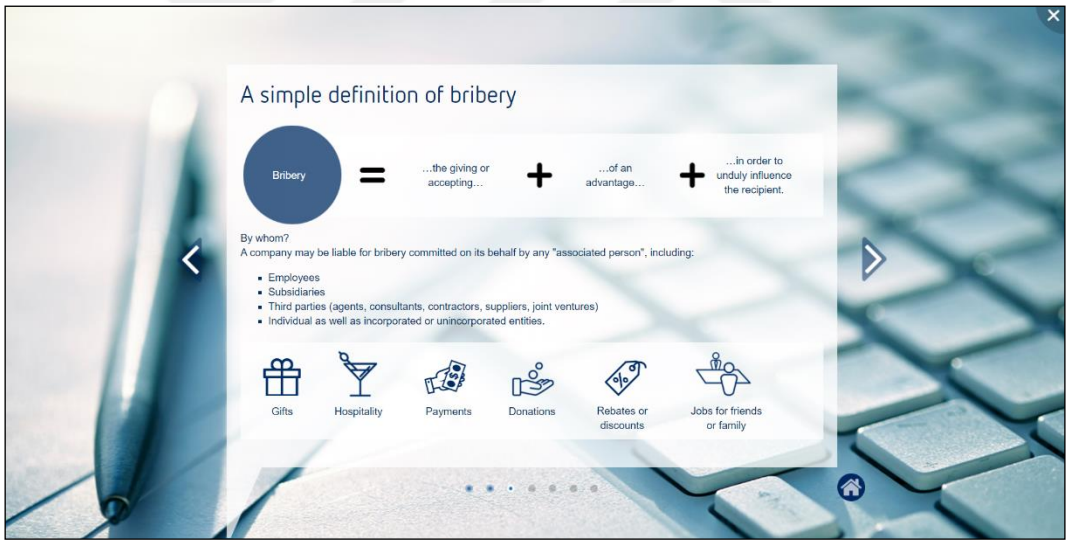

Figure 1. Example to e-learning page interface design - Visually appealing

easy to scan, orderly and simple. A successful layout present a clear path for the eye, helps to user to reach to the next step and draws a proper emphasis to the GUI elements (Clark & Mayer, 2016) as well, it should make the page's appearance visually appealing.

Figure 1 can be a proper example for an e-learning design page which is appealing. The icons are in order and the sentences aligned with bullets the main idea of the page summed up at the top of the page with the colours in harmony. We can see the focal point which is the subject in a blue circle.

2.3.1.2.Typography

Garrett (2010) defines the term typography as; "the use of fonts or typefaces to create a particular visual style". Typography is an essential element of an e-learning design and the design of a text directly affect the user's understanding and attention to the content. It is predictable that if the text cannot convey the intended content if it is not legible (Hartson & Pyla, 2012, p. 799) Easy-to-read typography and a lucid visual hierarchy deserve user's attention. Clear, minimal text is beautiful when well-presented and during the reading of fancy typeface human eyes quickly gets tired. Simple fonts are used to avoid font fatigue, as well as prevention of page complexity. Allen (2011) advices to use text to help learners perform, study, and locate help. Hartson and Pyla **(**2012, p. 800) suggest using good contrast with background, avoiding too many different sizes, fonts and giving place in the content the fonts like Ariel, Sans Serif Verdana or Georgia for online reading. As well as Helvetica is a preferable font for clear readability. Paragraphs should be kept short, and convey one idea per paragraph. Graphic conventions should be used consistently as variety of fonts are used, it will cause complexity. In the Figure 2 is presented as a well-chosen typographic design example. The size of the fonts are even with short paragraphs. The contrast with the background and the colours are chosen for the fonts are coherent. The texts are easy to read, they do not cause eye fatigue. With the same background when the typography is changed in sense of colours, fonts and consistency in the

Figure 2. Example to e-learning page interface design – Typography 1

Figure 3. Example to e-learning page interface design – Typography 2

Figure 3 there appears a noticeable complexity because of different font choices. The heading ‘Looking for excuses’ causes reading difficulties because of the contrast as the colours of the fonts and the colour of the background has similar saturation. The heading ‘Pitying yourself’ draws the attention with so small fonts and like the last

heading chosen fonts cause a chaotic view, also with eye disturbing yellow hue and unreadable typography. Briefly, consistency and simplicity of the typography of the interfaces the two most basic features of decision making.

2.3.1.3.Colour

Among all the GUI elements, the use of colour is the most emotional component; it should be made sure that colour is used to reinforce other design elements such as text, icons, graphics, and physical size and location (McKay, 2013, p. 158). Colours facilitate the detection of objects but it can be possible in case of selection of colours thoughtfully.

In interactive software systems Johnson (2020) present five guidelines for using colours:

1. Distinguish colours by saturation and brightness, as well as hue.
2. Use distinctive colours.
3. Avoid colour pairs that colour-blind people cannot distinguish.
4. Use colour redundantly with other cues.
5. Separate strong opponent colours.

Figure 4 presents an e-learning interface with distinctive colours. Saturation and brightness of the colours are attractive and they support other elements in the page.

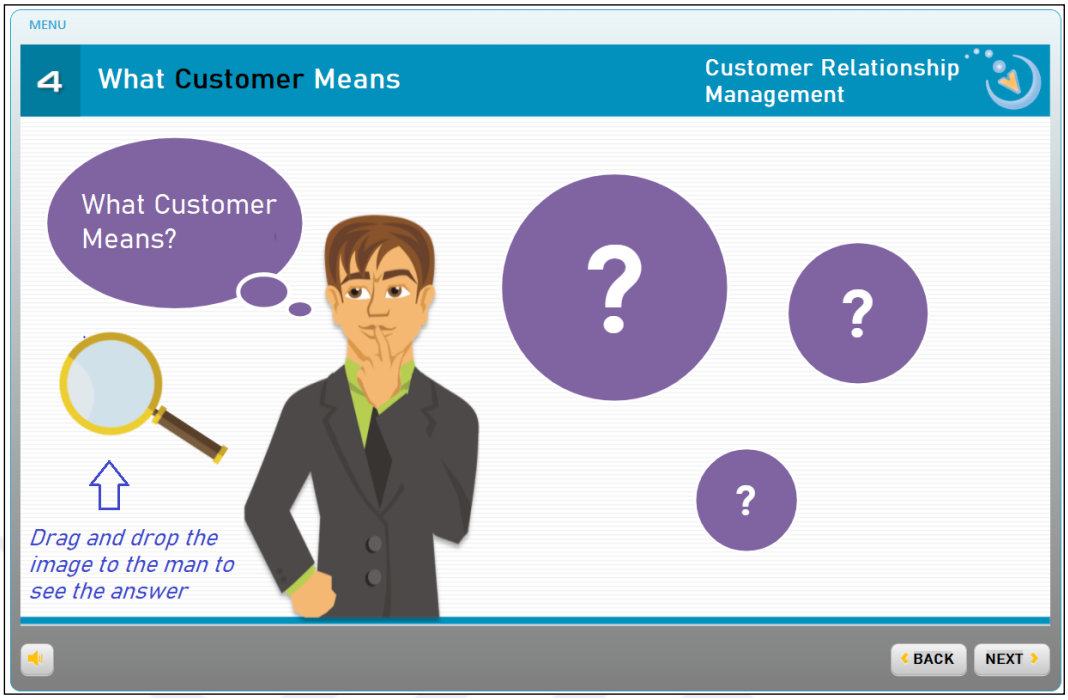

Figure 4. Example to good designed e-learning page interface – Colour

In the Figure 5, when the user marks the right answer option in the box change the colour and turns to green. Using green colour can be problematic for colour-blind people but the text appears below also supports the colour, so the user can understand either the answer is right and wrong. But in the Figure 6, when the wrong answer chosen the box turns to red which is another problematic colour for colour-blind people and there is not any supportive text; so we notice here a wrong colour selection.

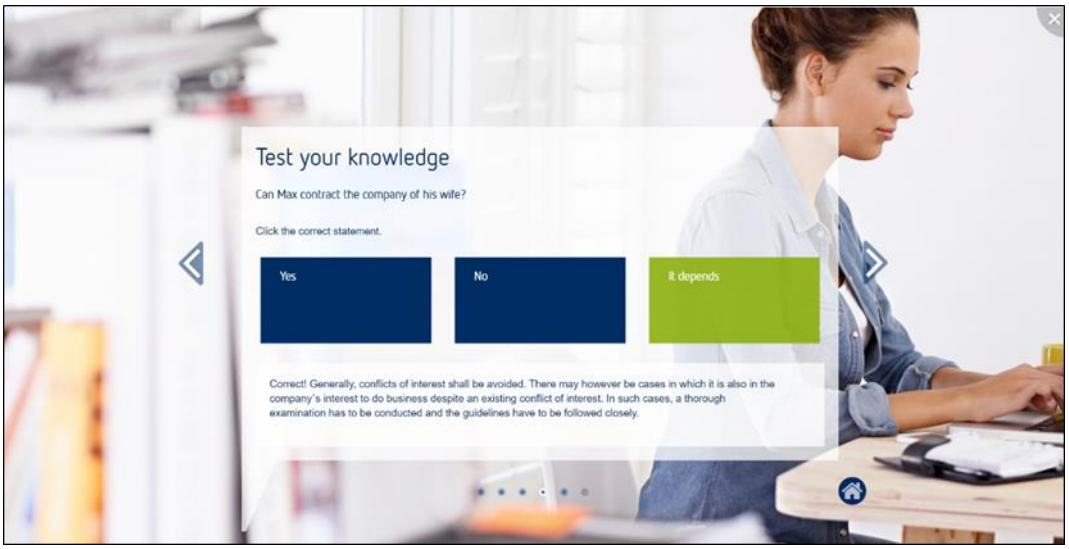

Figure 5. Example to e-learning page interface – Colour-blindness 1

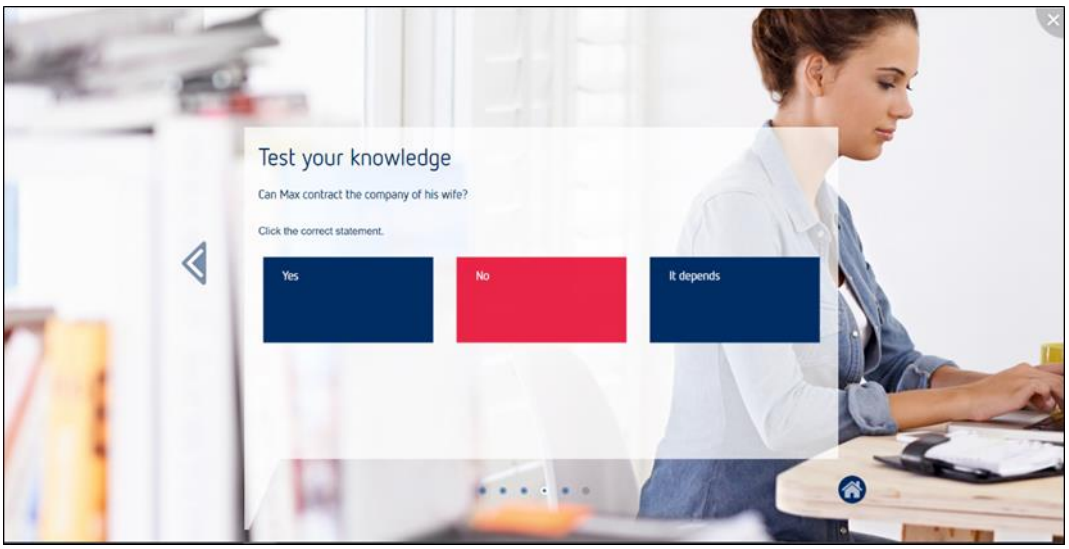

Figure 6. Example to e-learning page interface – Colour-blindness 2

The trend in colour using is just to be simple to create a clear design. McKay (2013, p. 163) suggests using the strongest colour for the focal point. Shades of red, purple and orange are often used for this purpose. Though, certain colours – like red – make things appear more important (Mathis, 2011, p.163). Another consideration is

compatibility for the user; 8 to 10 percent of people are colour blind, and red-green colour blindness is the most common form of colour blindness (Allen & Chudley, 2012). Such as colour blindness, the age of the user group can be another subject matter to pay attention. If e-learning designing is made for workplace learning, a document of listing the acceptable colours to the company's corporate identity can be an issue to be emphasized for use in company materials.

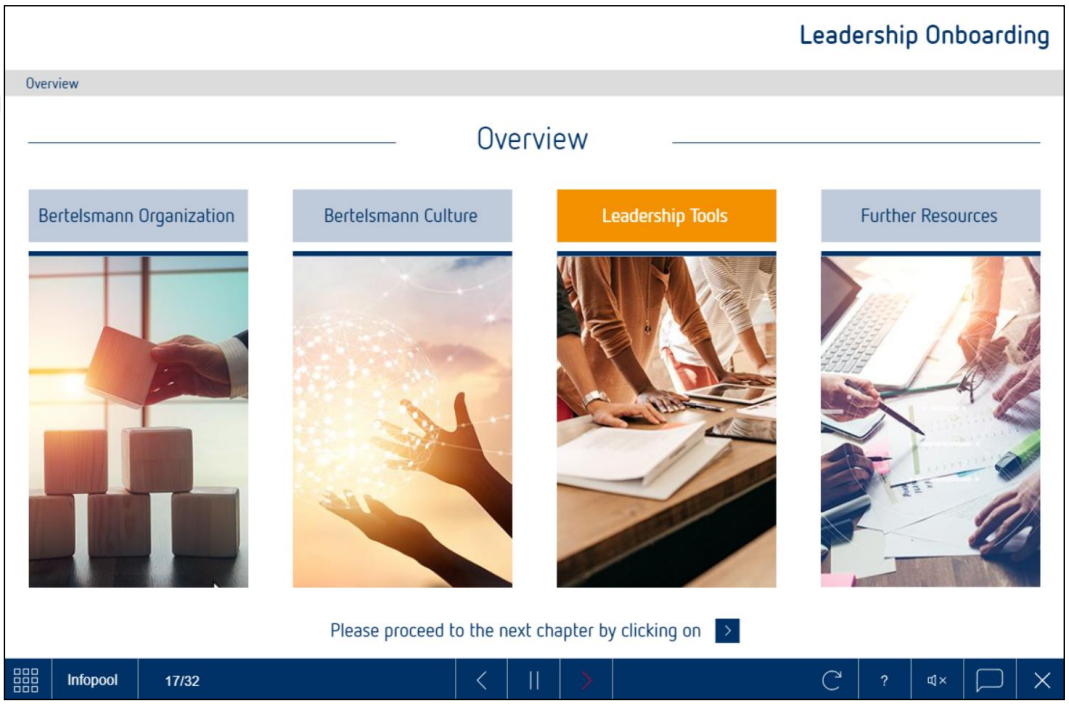

Figure 7. Example to e-learning page interface – Corporate identity and focal point

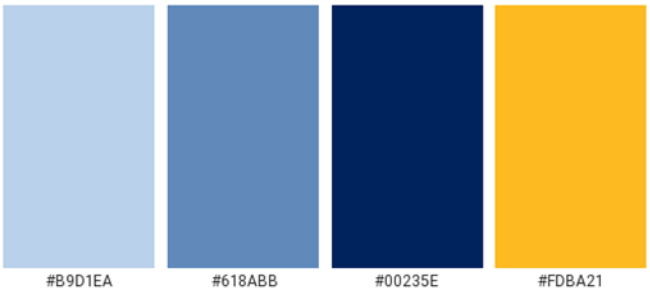

Figure 8. Corporate colour palette

Figure 7 presents an e-learning page interface uses the corporate colours on the design. The branding colour palette of the company is announced to Internal Communication and Design department if exists. In the Figure 8 the colour palette of the company is shown. Figure 7 is also an adequate example for focal point usage, the heading ‘Leadership Tools’ is easily discernible because the designer used the orange colour to strengthen the look of focal point, as this is the heading the user about to reach.

2.3.1.4. Icons and Images

Ghirardini (2011) explains the term of ‘icon’ as ‘a simple symbol representing a complex object, process, or function’. McKay (2013, p. 169) defines an icon as a small picture that is used to label an option, command, or object. Reiss (2012, p. 148) claims that there are only four icons can be recognized by most of the people:

- Magnifying glass (search)
- House (home) (Figure 9)
- Envelope (contact/mail)
- Printer (print)

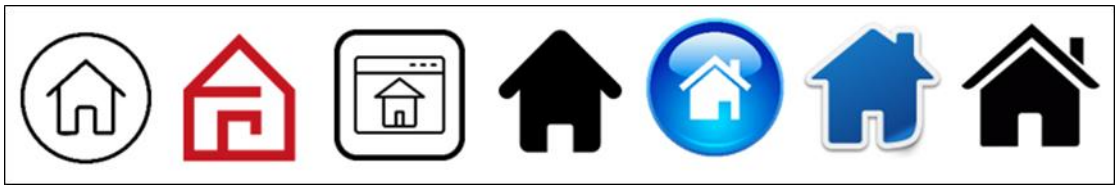

Figure 9. Examples of ‘house (home page)’ icons in variety of designs

When the icons are well known and familiar to users; so the commands will be clear although there are no labels. The play and pause icons in the Figure 10 shows to

the user if they click on the icons they will play the video or the audio and they can pause it if it is playing. These icons also have global understanding and leave familiar effect on the user. When the icon labelled it will be much more recognized, but, even though there is no label, icons should be meaningful and the users should guess where to lead and need to understand what icons and graphics mean (McKay, 2013, p. 132). In the paper of Gutwin (2020) it is claimed that; icons with concrete imagery were learned much faster than abstract icons. Icon-based user interfaces have the user click on onscreen buttons instead of typing commands and easily recognizable icons can trigger the activation of related concepts in the semantic network of long-term memory.

Figure 10 . Play and pause icons

An image can worth 1000 words, and sometimes with images we can tell a story that words cannot explain says Reiss (2012), though sometimes, not only images enough to explain the facts and the content. When we mention about the content we mostly refer to text, but images also give to text more inviting look. When designing for web, DiMarco (2006) advices to keep photos and graphics separate as well, keeping consistency of image styles and images should relate directly to content. For workplace learning also style relates with corporate image, inconsistency undermine the clarity of your corporate image (Garrett, 2011, p. 163)

2.3.1.5. Navigation

Navigation is how the instruction is designed to facilitate understanding of content and the way learners move through the instructions (Zaharias & Poulymenakou, 2006), moving through the pages of an e-learning. Peters (2014) advices designing navigation for experts to provide full control, but for novices more limited control, though, the navigation interface should be intuitive for anyone. An e-learning designer is responsible to provide a framework to organize pages and lessons for reliable navigation. As well, for adult learners giving the freedom of control over the pages and content is relevant with adult learning.

E-learning interfaces usually allow the following navigation techniques:

- Course and lessons menus, which allow learners to select specific lessons and topics within the course
- Previous, next and reload buttons to permit control of pacing within a lesson.

(Ghirardini, 2011, p. 93).

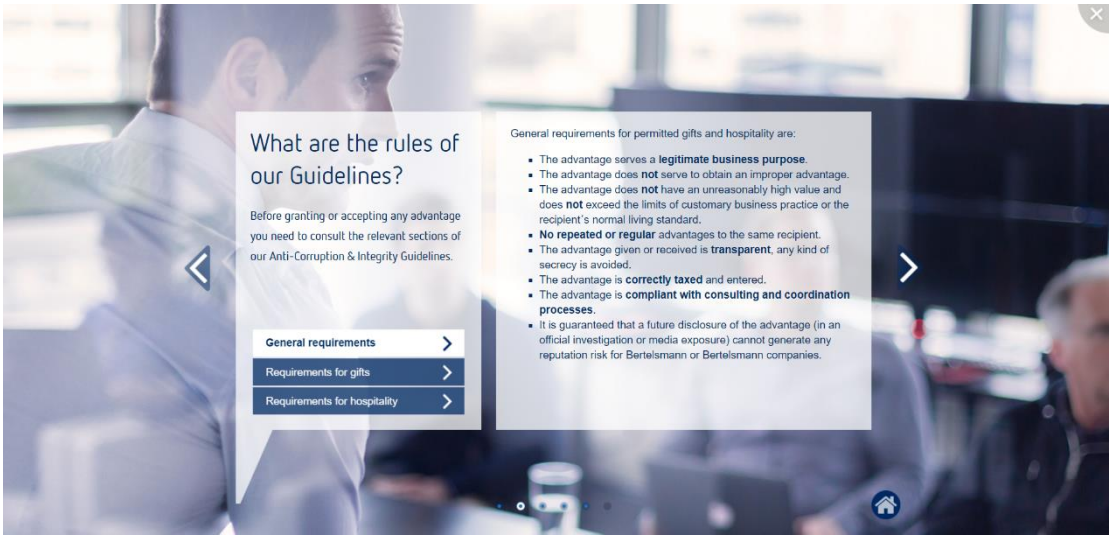

Figure 11. Example to e-learning page interface – Navigation

In the page (see Figure 11) there can be seen headings which carry the users to the related subjects, as a correctly working navigation. When the cursor on the heading ‘General requirements’, on the right the explanations about this heading can be seen. As well, the other headings show the related content seriatim. Additionally, when the user clicks on the home icon, the icon directly navigates the user to the home page and the ‘X’ icon navigates to the beginning page of the LMS. Here, the designer presents a familiar look to the users and gives the opportunity to access previous pages to the users.

When designing navigation, the mental processes of the users with their expectations about the page orientation should be considered, as well as there should be generated a navigation that can provide a faster visual recognition of the elements (Leuthold, Schmutz, Bargas-Avila, Tuch & Opwis, 2011).

3. RESEARCH METHODOLOGY

3.1. Data Collection

In this section of the research, it is presented how data was collected throughout the user-centred design process. As well as the research methodology, the following sections describe results.

3.1.1. Usability Testing

Providing a user evaluation, works through a successful usability testing. In usability testing, the sample of users are implemented predefined tasks. Hertzum (2020) defines basic components of usability testing as below:

- Instructions and tasks: The users exercise and interact with the product that the subject of the usability testing defined in the instructions.
- Verbalization: During the test application, users verbalize their thoughts (thinking aloud)
- Reading the user: The evaluator's' observes the users and analyses how well the product supports the users in accomplishing the test. The evaluator listens and watches the user's interactions with the product.
- Relationship between user and evaluator: The user should feel free and open to communicate so he/she will not hesitate negative/positive responses. It is evaluator's responsibility to provide this environment.

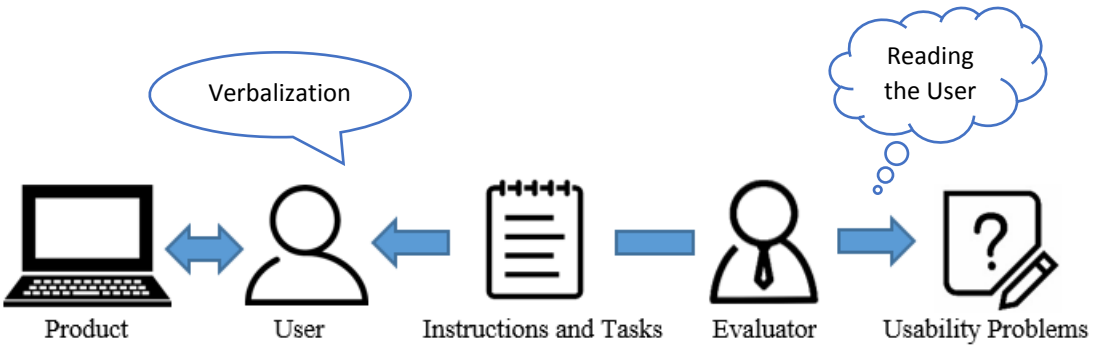

Figure 12. The basic components of a usability test, based on Clemmensen, Hertzum, Hornbæk and Yammiyavar (2009)

Usability evaluation to investigate their usability, which is defined in terms of their effectiveness, efficiency and the satisfaction of their users. For the research The Wheel Model of Harston and Pyla (2012) have been used (see Figure 13). In the Wheel model for our research are the steps begin with 'Evaluation' and it aims to verify and refine interaction design, then the next step is 'Analysis'. The intention of this part of the wheel is understanding user work and needs (p.54).

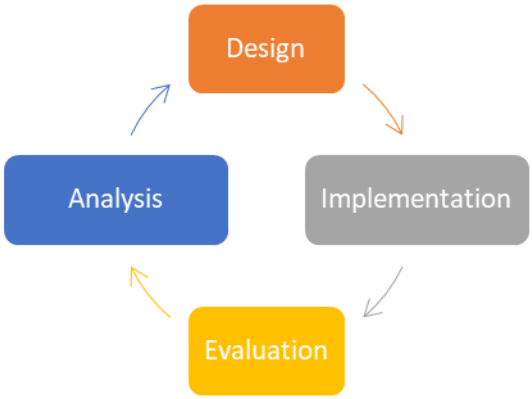

Figure 13. The Wheel model of the design process, based on Harston and Pyla (2012)

Dumas and Reddish (1993) suggest to interactive-systems designers that before releasing process of a product to the public, the product should be experienced and tested. The implementation of the usability testing aims to give recommendation to designers for this specific interface design and applicable to similar e-learning contents. Regardless of the content, some features of the e-learning design was presented to users to implement specific task steps. According to Adelman and Riedel's classification of usability evaluation methods (1997), there are three methods; heuristic, subjective and empirical.

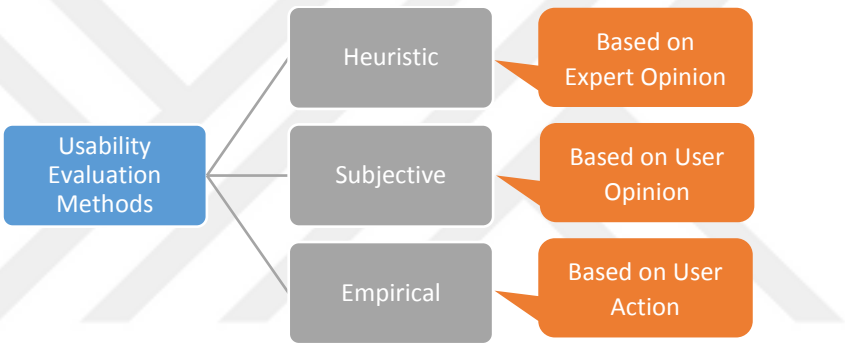

Figure 14. Adelman and Riedel classification of usability methods (Adelman & Riedel, 1997)

Çağıltay (2018), adds to two more methods named; user guides and model based approaches. During the research the approach of the method is chosen as 'empirical'. The method based on user action and with real users, real user interface is used with real tasks and by analysing collected data the aim of the usability testing is re-evaluation of the content.

3.1.2. Moderated Tasks Tests and Structured Questionnaire

The research data has been collected with moderated tasks test. In a moderated tasks test, during the implementation of the tests, the researcher observes the tester (Mathis, 2011). In the beginning or when the tester perform the test, the researcher introduced the testers to different activities or tasks; guided them through the tasks and gives feedback. As stated previously, the researcher also acted a role as a facilitator during the application. During the implementation, the testers received guidance but this guidance did not affect the task success or did not include assistance for the successful completion of tasks.

A questionnaire is a set of questions for collecting information in an organised, systematic and methodological manner from individuals (Malhotra, 2006). It is a document containing questions designed to collect data to analyse (Babbie, 1990, p. 377). Structured questionnaires include pre-coded questions and the answers limited with scales to quantify the subjective or responses. Although the term of 'structured' used in this research both for questions and the answers, sometimes it addresses either to questions or the answers (Acharya, 2010). The structured questionnaire was prepared for the aim of receiving feedback from the testers about their usability experience and contained 14 questions with 5-point scale and shared with the participants in paper form following to usability testing implementation.

3.1.3. Observation and Semi-Structured Interview

Observation, is the method of data collection that fit into the general category of qualitative research. The methodology is the way of evaluation that collects data by observing experiences of the users who are the subject of the research with a product (Barendregt, Bekker & Speerstra, 2003). Here, the term refers to inconspicuous

observation of practitioner-user interactions by allowing someone to monitor and note what is happening in an application event. As Pogrebin (2003) denoted in his definition of participant observation, the method is appropriate for studies of almost every aspect of human existence (p. 17), using this method was inevitable for the researcher in the research as 'human' was is the equation. As a supporting statement to this, Diah, Ismail, Ahmad and Dahari (2010) claim in their research paper that proved itself in many researches as one of the best technique that could be used in usability testing.

During the users performing the tests, observing tacit and explicit behaviours and taking fairly accurate notes were quite essential. Though, in this case, the observation also included monitoring the human-computer interaction and system flow to intervene in case of any technical problem occurrence. Sometimes the users performed thinking aloud reflections –which is a method of reflection that while solving a problem and analysing the resulting verbal protocols Van Someren, Barnard and Sandberg (1994) and asked questions about how to continue or fulfil the tasks. The records were taken for verbal reflections but it was made clear that they could not be helped as well as should accomplish the tasks by themselves.

Upon completion of each usability tests, for the purpose of gathering detailed information the users were asked to give feedbacks about their experience with a semi-structured interview questions. Schmidt (2004, p. 253) defines the semi-structured interview designed and carried out in the spirit of qualitative research. Also, semi-structured interview, is an interview technique which focus on specific themes but cover them in a conversational style and inversely to formal interviews there are no completely formatted set of questions (Raworth, Sweetman, Narayan,

Rowlands & Hopkins, 2012). As the research was carried out in the framework of qualitative research the interview method was a beneficial and sustaining.

During the implementation, the conversation intentionally kept informal, but the participants got informed about the interviewer's note-taking activity. As Selltiz, Jahoda, Deutsch and Cook (1965, p.576) mentioned in their half a century old foresights the interviewer's manner should be friendly, courteous, conversational, and unbiased. Without manipulating the ideas and experiences of the users, they had been asked about their system using experience about other subjective inputs regarding the product such as levels of satisfaction, ease of use and visual appearance of the e-learning. Thus, conducted as must-haves in the interview, with-it, during the interview, the users gave valuable information that was not anticipated by the researcher although a short time devoted to semi-structured interview. The outcomes can be presented as a proof of that semi-structured interview was the right method as an application.

3.2. Method of Data Analyses

3.2.1. Qualitative Data Analysis

In this research the data was collected with moderated tasks test as well as with semi-structured interview. As well, the observation and questionnaire data supported the main concern of the research. The need of comparison of data and finding a proper answer to research questions gave rise to the need to use the qualitative method as analysing method.

Qualitative data analysis is used in qualitative studies and the word 'data' is used for both 'texts' and 'numbers' (Grbich, 2012, p.192). The analysis method is fundamentally case oriented (Bazeley, 2013, p. 5) which mainly focuses on data

handling of human and their life styles, behaviours, social changes and such. In the research, the high proportion of data is text based, consisting of verbatim transcriptions with addition of questionnaire answers. To understand the story behind a user's experience as McNamara (1999) described that interviews in qualitative research are very useful, and go further to get the in-depth information about the subject. As the user experience is highly related with people's point of view, qualitative method is chosen as this is considered as the best way to reflect their reflections. The mode of access to subjective viewpoints qualitative data analysis can be described with the method.

3.2.2. Conversational Analysis

In this research, conversational analysis method has been used to analyse the outcomes of semi-structured interview, the feedbacks of the users analysed with the guidance of usability elements and according to the main titles suggested in the usability test. Conversational analysis is a phenomenon first coined in 1964 by Harvey Sacks as Schegloff reported in his introduction to the published collection of Sacks' lectures (Schegloff, 1992). Sacks, pointed out that it is essentially an organization in the way that interaction occurs turn-by-turn. Conversational analysis is an approach gathers its data of naturally-occurring interactions and it is an approach in social research. Hutchby and Wooffitt (2008) explains conversational analysis as 'the study of talk' and more complexly they refer to 'systematic analysis of the talk produced' Conversation analysis is the study of talk-in-interaction and it characterized by the view that what the conversation means and the meaning is determined by the listener though, it is not taken as a simple talk, the talk is produced according to its aim (p. 1) The researchers in the field, aims to implement the method with the groups

and transcription of their dialogs, in this research, the transcription was made according to data received to the researcher via conversation between facilitator and participants' thinking aloud reflections, as well as semi-structured interview.

Transcription of the talks mainly focused on the themes in Table 1:

Table 1

The Table of Coded Key Words

Themes	**Key words examples**		
Typography	Font	Consistency of fonts	Text
Page Components	Layout	Ease of directions on the page	
Navigation	Successive pages	Returning to the main page	
Pictures/photographs/icons	Icons	Pictures	Photographs
Colours and aesthetics	Page visual appearance	Colours	Hue of the images

3.3. Participants

3.3.1. Information about Participants

Participants are employees of the logistics company serving in the private sector. The participants are adults-learners, older than 18 years old with the knowledge of basic computer skills at least. There shaped two user groups, group one is formed with the users who has e-learning using experience who the second group has formed with the users who never experienced an e-learning content usage.

Table 2

The Participants of The Usability Test

Tester Alias	Gender	Age	E-learning Experience
Tester 1	F	35	Experienced
Tester 2	F	21	Non-Experienced
Tester 3	M	21	Experienced
Tester 4	F	41	Non-Experienced
Tester 5	M	23	Non-Experienced
Tester 6	M	25	Non-Experienced
Tester 7	M	29	Non-Experienced
Tester 8	M	29	Experienced
Tester 9	F	27	Non-Experienced
Tester 10	F	26	Experienced
Tester 11	F	42	Experienced
Tester 12	F	36	Experienced

The research sample includes 12 employees, without distinction criteria of gender, age and education. The focus groups bisected as experienced (n = 6) and non-experienced (n = 6) each group, consists of 6 users. Table 2 represents the information

about participants which they are referred as ‘Tester’ in the narration of the remaining chapters in the research.

3.3.2. Selection of Participants

When the implementation was conducted there were 1100 employees in the company. The sample mass was carefully selected as many of the employees had been already taken the course. As well, the participants were selected from among employees with no distinction between white and blue collar with the assumption of ‘no previous e-learning experience’ second group can be found in blue collar employees and selected from this population. Therewithal, a brief information was requested from the managers of the employees to provide talkative and perceiving well profiles in order to provide better data and to facilitate the implementation. Relatively to the research topic, according to Cameron (2010) people should be chosen on the basis of their experience. The assumption has fed by the awareness of LMS system account creation is made according to e-mail existence of the users and from their previous experiences there is more possibility for white collar employees having e-learning usage experiences as it is common method for regular and compulsory trainings are shared online instead of delivering with the method of classroom training. The groups are formed without distinction criteria of gender, age and education. But when the collected participants invited for the application they got asked about their previous e-learning experience, it is observed that there was no correlation between working at the field or in the office. Consequently, the two groups were formed according to their answer to the question about their e-learning experience.

Nielsen, Lewis and Virzi claim that 80% of usability problems can be discovered by only five users. Lindgaard, Chattratichart, Spool, Schroeder, Hwang and Salvendy,recommend using more than five users (Alroobaea & Mayhew, 2014) In 2001, Spool & Schroeder experienced a usability test with more than 5 users and observed 13th and 15th users revealed new user problems; when in 2002, Perfetti & Landesman tried 18 users and between 6-18 users, they explored more than five obstacles. In the light of all, the thesis research usability testing was conducted with 12 participants in total.

3.4. Task and Implementation

The e-learning content subject to this research is the training content titled as ‘Information Security Awareness’ offered to users through the company's cloud-based SAP SuccessFactors platform. The training content is actively presented to employees in the company**.** This training had chosen with the awareness of the researcher that; there were design problems in the content. Regardless of educational content, the design was examined by testers according to the scenario.

In accordance with the opportunities offered by the system, after an employee logs in the platform, there are listed the trainings have assigned to the employee. On the list of assigned trainings, the employee (therewithal the learner) chooses the e-learning content. An opening screen meets the employee, then the user needs to start the e-learning content. The subsequent steps include screens which are subject to our research. The transactions are as follows, respectively:

Figure 15. The entrance page of the course content

The entrance screen (See Figure 15) contains pictures and texts. By clicking on the arrow is shown next to ‘Click’ on the screen, it can be proceed to the next page. In addition, it is possible to scroll through the pages by clicking the small dots below.

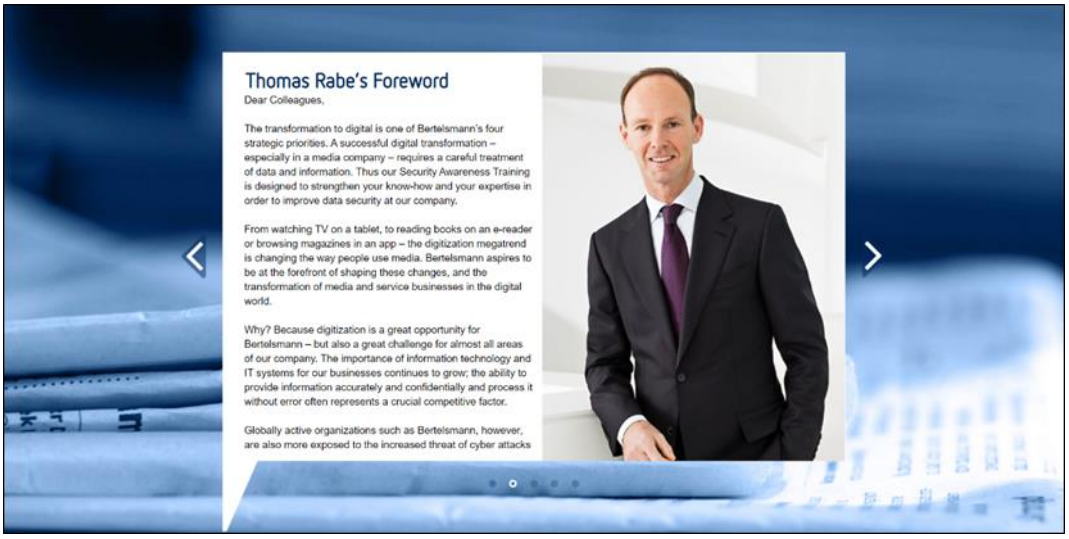

Figure 16. The second page of the course content

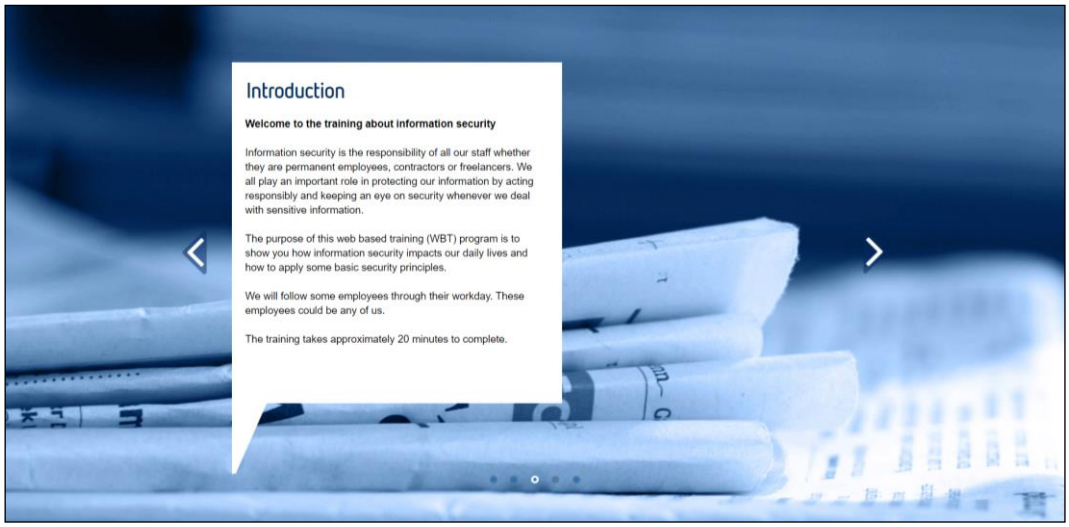

Figure 17. The third page of the course content

The next page (Figure 16) shows an explanation text and a picture. By clicking on the arrow pointing to the right, it can be proceed to the next page. In addition, it is possible to scroll through the pages by clicking the small dots below. For instance, when we click to the third dot at the bottom of the screen, there can be reached to the screen can be seen on the Figure 17, as well, the same page can be accessed by clicking the arrow in the right corner of the page. For the intention of reaching to the last slide, the same method applies. The user can click on the dot in the fifth row or click the arrow twice while on the third slide.

Figure 18.. The home page of the course content

Home page (Figure 18) greets the user when last slide has accessed, various icons appear on this page. Afterwards, when the cursor is brought closer to the icons at the bottom of the page, the relevant titles appear on the screen, and when the icons are clicked, the training content of the relevant topic is displayed. After completion of related subject, a check mark appears on the icons. On the screen, each icons can be clicked without order – relatedly the content can be viewed without a rationale logic – . The subjects leaded by the icons are represented on the Figure 19.

Icons	The subject leads
	Breaking news
	Arriving at work
	At the office
	Short break
	Meeting with a supplier
	Check e-mail and print documents securely
	Shift change
	On the way to supplier
	End of the workday
	After work

Figure 19. The icons used in the home page

To reach related content belongs to the title, it begins with a video, the video automatically starts to play when the page is viewed; but it can be posed by the users depending on the request of them (Figure 20). There can be switched to the next slide without waiting for the completion of the video. Again, both possibilities can be used for jumping to the next slide: clicking to the arrow on the right corner of the page either clicking to the dot at the bottom of the screen.

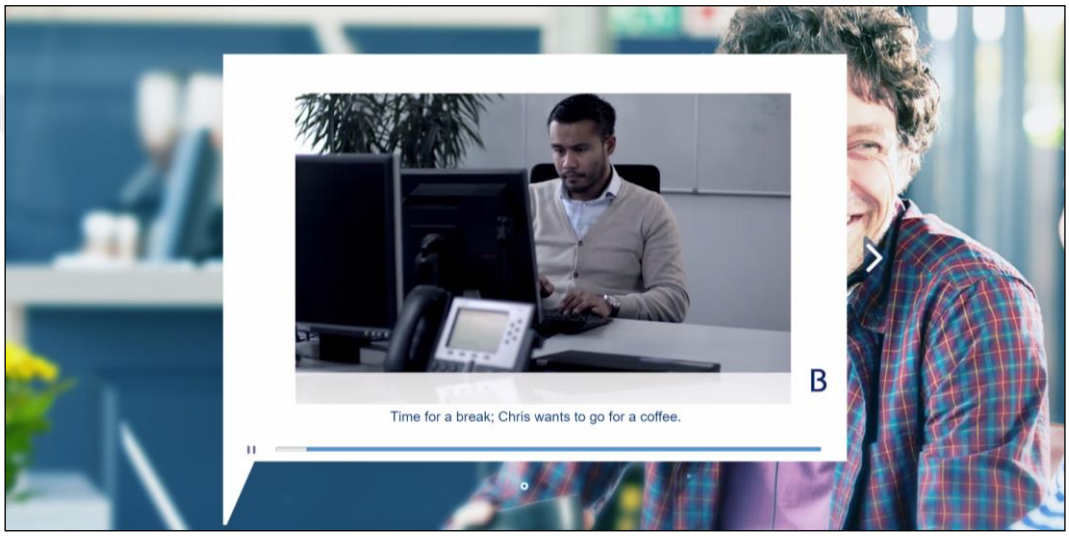

Figure 20. The page of the course content leaded by the heading ‘Short Break’

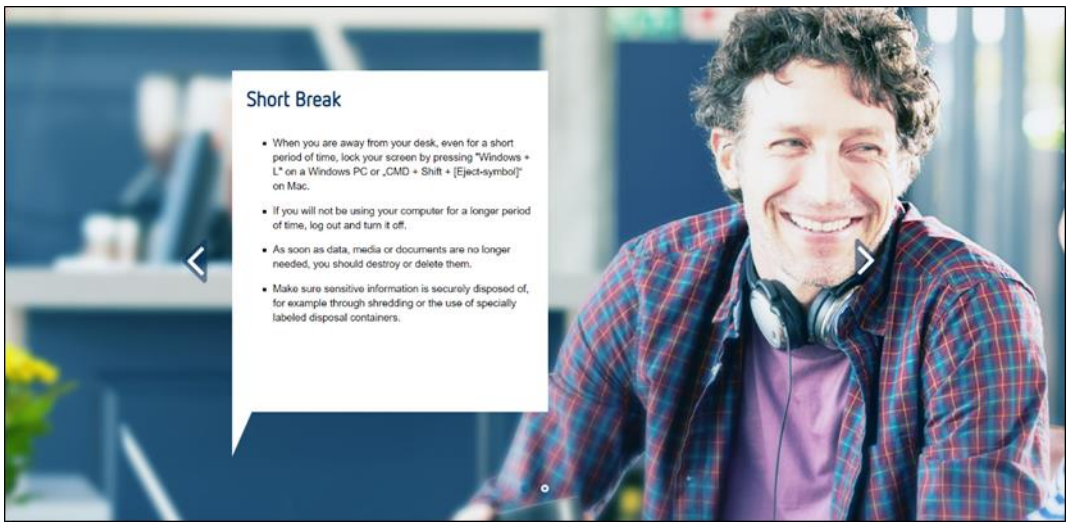

Figure 21. The next page of the course content leaded by the heading ‘Short Break’

As soon as the user reaches to the next slide, it consists of a need to return to the home page. There is only way to return to the home page is clicking to the arrow on the right side of the screen. The arrow is not so visible, as it is positioned on the chin of the man on the photograph used as a background image can be seen on Figure 20. To prevent language problems, with completely same designed interface Turkish version of the content presented and applied to the testers. During the implementation of the usability test, the instructions were given to the testers step by step and it is firmly stated not to move without direction. Basically the testers were independent between each task but they were limited for transitions between pages.

The testers were called to sit to the test environment after the content entrance page is ready. In the beginning of the application, the feedback form was presented to the testers with the intention of ensuring them what will happen. The tasks had planned before the implementation of usability testing according to steps declared above, it was stated that people only visually examine the content of the training without the need to review it for understanding. The directions were given out loud during the implementation to all the testers with the same order without time limit. Regardless guidance in details there were six tasks:

Task 1 – The tester is asked to start the ‘e-learning content’

Task 2 – The tester is asked to move to the next page

Task 3 – The tester is asked to reach to the last slide and see ‘Home Page’

Task 4 – The tester is asked to find to the subject ‘Short Break’ and click it

Task 5 – The tester is asked to pose the video

Task 6 – The tester is asked to return to ‘Home Page’

The testers were recorded during their implementation of usability tests, the video capturing was avoided to distract their concentration and the record was made without showing their faces but the computer screen, with the intention of catching their process times and thinking aloud reflections. During semi-structured interview the video recording was stopped to provide relaxed environment. The facilitator took detailed notes and informed the testers about note taking. The scenario steps were explained in the Figure 22. It was also used as a guideline to the facilitator. Through the guidance of the steps, all users were tested by following the same steps.

Figure 22. Usability testing scenario steps

Table 3

Usability Test Questionnaire

Question Number	Questions by main topics	Minimum	Maximum
Typography			
1	Readability of the fonts	Very difficult	Very easy
2	Size of the fonts (largeness)	Very insufficient	Very sufficient
Page Components			
3	The layout of the page components was very helpful	Never	Always
4	I reached the place I want to reach while browsing the pages	Never	Always
5	I felt comfortable when I was performing the tasks	I was not comfortable at all	I was quite comfortable
Navigation			
6	Successive pages	Confusing	Organized
7	The pages to be encountered when clicking on the images	Unpredictable	Very predictable
8	Returning to the home page	Not easy	Very easy
Pictures/photographs/icons			
9	The pictures/photographs/icons were adequate	Very inadequate	Very adequate
10	Pictures/ photographs/icons	Unrelated to titles	Related to titles
11	Pictures/ photographs/icons made my tour easier	Didn't make it easy	Made it quite easy
Colours and aesthetics			
12	Aesthetic adequacy of the page	Very inadequate	Very adequate
13	Appearance of existing colours	Very incompatible	Very compatible
14	Size of images	Very insufficient	Very sufficient

4. RESULTS

4.1. Task and Implementation

The first task (coded as Task 1) was easily succeeded by each testers. All the testers completed the task around a second, following two directions (Task 2, Task 3) were successfully completed as well, the same afford observed with Task 1. Comments of the testers began during Task 4, for this step, %75 of the testers completed the task more than 5 seconds. The users which are completed less than 5 seconds or in 5 seconds could find the heading ‘Short Break’ by accident when they move the mouse and in connection to it, the cursor, randomly on icons. The testers gave specific comments on icon problems they have experienced;

Tester 4: I did not get it was ‘Short Break’ I supposed the clock icon is ‘Short Break’

Tester 5: ‘Short Break’ icon can be a clock or hands ask for break

Tester 7: I cannot see any relation between ‘Short Break’ and the icon leads to there

Tester 9: I could not manage to guess ‘Short Break’ by looking to the icons

Tester 10: ‘Short Break’ icon is unrelated

Tester 11: ‘Short Break’ icon could be a coffee cup icon

Only Tester 6 commented as ‘Short Break’ is related. After the completion of all of the tasks, the testers were asked to discover all the icons in the page, so some of the testers reflected their visual feedbacks:

Tester 6: The clock shows 8 o'clock, end of our shift is not 8 o'clock! So I cannot see this as ‘end of the day’. ‘E-mail control’ heading seems nice, as it shows an envelope.

Tester 7: Here says ‘Shift Change’ but the icon does not help me to guess.

Tester 11: Icons can be clearer. For example I see there is a clock shows 8. Working time does not end at 8!

Tester 12: Icons do not serve what they mean, it is easy to use but the heading should be there always and they should not appear only when I move the cursor over it.

Task 5 was easily implemented by the users. Some of the testers commented on the stage as below;

Tester 5: I did not have difficulties to pose video because it is like as usual we watch videos, the way I am familiar.

Tester 6: I was easily able to pose the video as I am familiar to this interface from YouTube, also the video websites I know have the same design.

Tester 12: It is nice to see the video also pause when I click on the video, not only to pause button.

Task 6 is observed as the most problematic stage of the usability testing. This is the stage in which the testers spent most of the time of the implementation of this step. During the implementation of this task, the testers were informed that they can give up if they fail to follow the given instructions. 33,33% of the testers were failed on this step; and the same percentage of the testers, even though they could managed to

complete the task, they sought for help from the facilitator. On this stage, more than half of the testers tried to use the keyboard for extra solutions until they had received the reminder by the facilitator that they can complete all the tasks with the help of the mouse.

Some of the testers really had a hard time with the content so they reflected their burden with thinking aloud reflections like Tester 1:

> Tester 1: I cannot find the return icon!
>
> Facilitator: You can give up if you feel like you are not finding it. Do you want to give up?
>
> Tester 1: Not actually, but I cannot find it. There should be an icon!
>
> Facilitator: (When she observed that she was over desperate) You can give up whenever you wish
>
> Tester 1: Ok! I am giving up! Normally following pages were in order but, the back icon was not there, it was really difficult! Maybe I missed the point!

There were similar dialogs with the other testers which were performed with Tester 5 and Tester 7:

> Tester 5: How can I return back, should I click to the next icon?
>
> Facilitator: You should find it, I cannot tell you.
>
> Tester 7: Here is a huge problem about turning back to home page! I think here should be an ‘X’ icon!

During the semi-structured interview, the testers gave a lot of feedback on this topic:

Tester 2: The last step was difficult

Tester 3: In the last task, in the page… There should be a ‘home’ icon so we can go back to icons page (He refers to home page)

Tester 4: The last task was difficult, there could be a window to lead me to the home page.

Tester 5: Turning back to home page was so difficult.

Tester 6: There may be used a ‘Return’ icon for going back to home page.

Tester 10: There should be a button so I can reach to main page, I am looking for a button down on the page. Maybe home icon or company logo can be used.

Tester 11: There should be a home icon for returning to the main page, it should fit to global understanding.

Furthermore, Tester 10, Tester 11 and Tester 12 underlined the inconsistency of fonts in Turkish version of the interface (See Figure 23). Tester 10 also mentioned about the blurriness of the pictures on the home page like Tester 8, and they declared that; this look gives an impression that design is unprofessional.

Figure 23. Turkish version fonts view of the e-learning content interface

Table 4

Task Completion Time and Success/Fail

Tester Alias	**Task 4**		**Task 6**		**Total Task Completion Time**
	Second	Success	Second	Success	Second
Tester1	2	S	144	F	183
Tester2	10	S	99	F	201
Tester3	37	S	4	S	111
Tester4	8	S	9	S	112
Tester5	18	S	24	S	138
Tester6	15	S	24	S	95
Tester7	9	S	54	F	138
Tester8	5	S	65	S	114
Tester9	6	S	28	S	103
Tester10	5	S	18	S	118
Tester11	8	S	62	F	129
Tester12	10	S	21	S	100

Furthermore, the tasks were measured according to completion time of each testers. Some of the testers failed Task 6 and the completion time was recorded as the time they decided to relinquish (See Table 4, Figure 24).

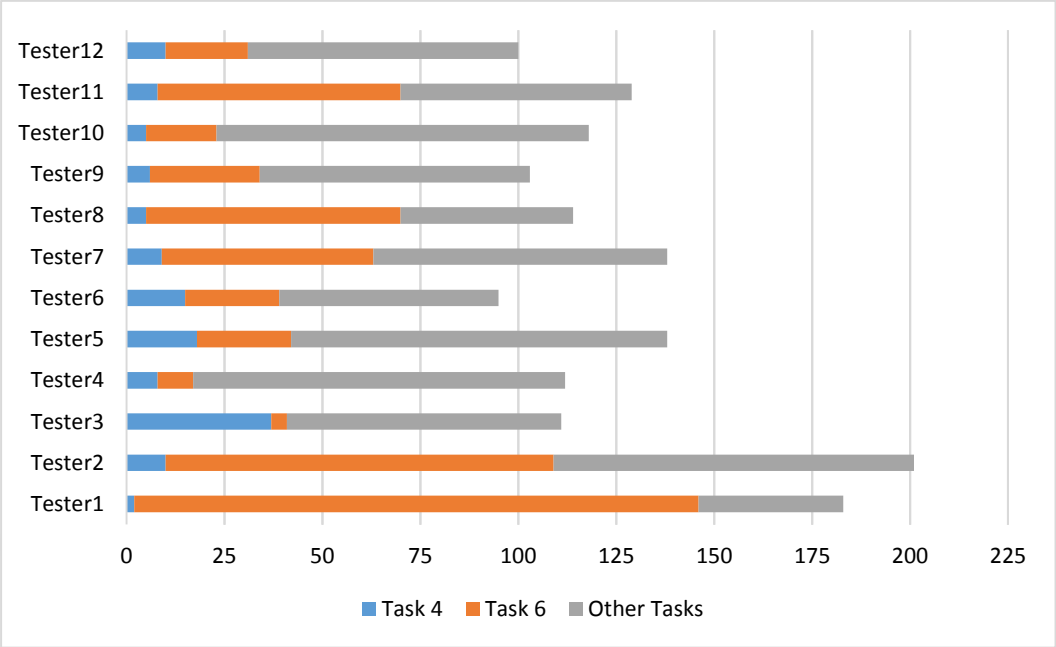

Figure 24 . Time spent on tasks by testers

4.2. Structured Questionnaire

The answers to questionnaire analysed with two approaches. Firstly, the comparison of experienced and non-experienced testers' answers (Table 5), secondly, grouping the questions addresses to usability elements (Table 6). Medians of the questionnaire results were compared on the Figure 24.

Table 5

Statistics of Usability Testing Questionnaire Results

EXPERIENCE			Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
NON-EXPERIENCED	N	Valid	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mean		4,83	4,33	4,5	4	4,83	4	4	3,17	4,67	3	4,17	4,83	4,83	5
	Median		5	4,5	4,5	4	5	4	4	3,5	5	3	4	5	5	5
	Mode		5	5	4[a]	3[a]	5	3[a]	3[a]	4	5	3	4	5	5	5
	Range		1	2	1	2	1	2	2	3	1	4	2	1	1	0
	Sum		29	26	27	24	29	24	24	19	28	18	25	29	29	30
EXPERIENCED	N	Valid	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mean		4,83	4,83	4,67	3,83	4,67	4,83	4	1,33	5	3,17	3,83	5	5	4,83
	Median		5	5	5	4	5	5	4	1	5	3	4	5	5	5
	Mode		5	5	5	5	5	5	3[a]	1	5	2[a]	4[a]	5	5	5
	Range		1	1	2	3	1	1	2	2	0	3	3	0	0	1
	Sum		29	29	28	23	28	29	24	8	30	19	23	30	30	29
Total Mean			4,83	4,58	4,58	3,91	4,75	4,41	4	2,25	4,83	3,08	4	4,91	4,91	4,91

a. Multiple modes exist. The smallest value is shown

Table 6

Usability Test Average Results According to Base Subjects by Experience of the Users

User Alias	**Usability Elements**				
NON-EXPERIENCED	**Typography**	**Page components**	**Navigation**	**Pictures/Photographs/Icons**	**Colours and aesthetic**
Tester2	5	4,33	4	5	5
Tester4	4	5	4	3	4,33
Tester5	5	5	4,67	3,67	5
Tester6	4	4,67	3,67	3,67	5
Tester7	5	4	2,33	4	5
Tester9	4,5	3,67	3,67	4,33	5
EXPERIENCED					
Tester1	5	5	3,33	4	4,67
Tester3	5	5	3,67	5	5
Tester8	5	4	3,67	3	5
Tester10	4	4,33	3,33	4,33	5
Tester11	5	3,33	3	4	5
Tester12	5	4,67	3,33	3,67	5
Total Mean	4,71	4,42	3,56	3,97	4,92

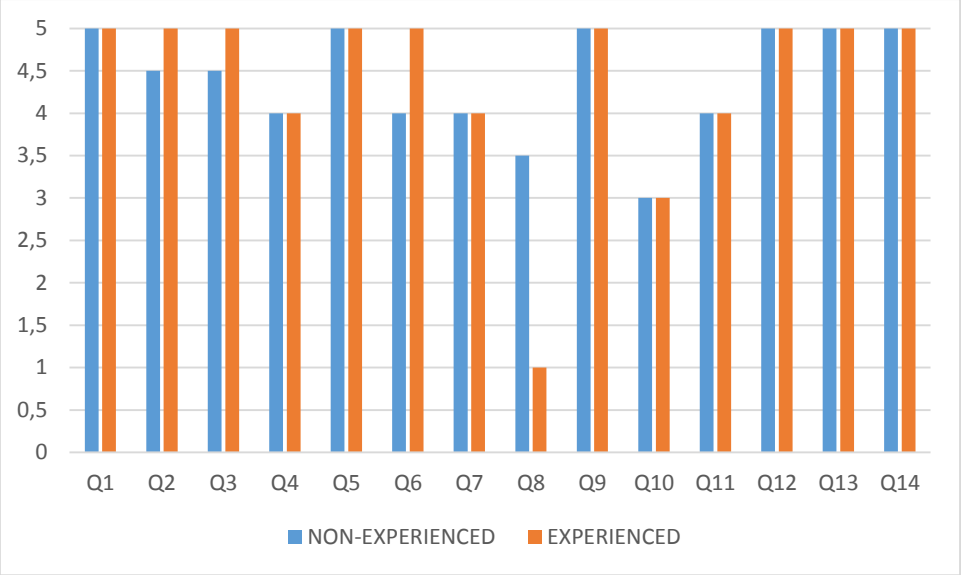

Figure 25. Medians comparison of the questionnaire result

5. DISCUSSIONS

The purpose of this research report is to evaluate the usability of an e-learning content GUI aesthetically by using appropriate methods and techniques. For this purpose, an asynchronous workplace e-learning content was selected. The data was collected both verbal; semi-structured interview and thinking aloud, and inscribed; questionnaire. Usability testing has provided the substructure of all the data and they evaluated empirically.

During the semi-structured interview when the testers asked to give feedbacks about their experience, the testers defined their experience in general as ‘easy’. As well as the GUI was summarized briefly as ‘aesthetic and minimalist’ and the content was found ‘constant and in harmony’. Thus, from the angle of semantic approach, the content can be evaluated as ‘usable’ or ‘well-designed’. From this point of view, as Çağıltay (2018, p. 95) discoursed that, this definition comprise almost no validity from the eye of HCI. To define usability of the content, there was needed more prominent and meaningful implications.

From the feature based definition, the most problematic features can be seen as ‘icons’ and ‘navigation’. Therefore, the source of the vicious circle of navigation is actually ‘nonexistence of an icon’. By evaluating only GUI features of the content it is not certain to clarify usability of the content (p. 98) but it can give a summary of aesthetically GUI needs of an e-learning design. In fact, this is the main area of the thesis but, because of the existence of more data which has been collected and analysed, it is preferable to add a discussion from the angle of ‘operational’ definition. Operational results can be defined for the thesis with variety of outcomes.

All the usability tests are valid for each groups, non-experienced and experienced the lowest average seems on the answers for Q8 and Q10 when all the answers evaluated the lowest mean belongs to the question Q8. Regardless the experience of the testers; Q8, included in the group of questions 'Navigation', Q10 is in 'Pictures/photographs/icons' (Table 6). By the results, it is not possible to say the navigation of the e-learning content is problematic, either pictures, photographs and icons. Besides, the total mean of the results of the usability test of related topics here reflects the negative usability experience of the testers. The mean of 'Navigation' related questions calculated as 3,56 and this result gave the lowest outcome of the five main headings. 'Pictures/photographs/icons' follows the 'Navigation' with 3,97. If it will be accepted the norm the total average of the all questions is 4,13; it can be considered that both of the topics have design problems. Aesthetically appearance of the content and the colours were found according to the test very successful with 4,92. Also, the feedbacks of the testers show that the content is visually appealing.

According to comparison of medians of questionnaire answers (Table 5 and Figure 24), only Q8 shows significant difference between the groups of testers. There can be said that the participants, whether experienced or not, had similar user expectations. It shows, the usability design needs of the workplace e-learning content is very similar for users of all experience levels.

The observation of the time spent on the Task 4 which is the task experiences were reflected to the questions related to 'Pictures/photographs/icons'. Task 6 is the task that experiences were reflected to the questions, 33,33% of the testers failed on this task. This result shows that, as McKay mentioned (2013, p. 130) if an icon design does not communicate the right way or anything, it is not meaningful to be there, or it

should be changed to something can be understood easily where to lead, help reinforce a sense of ‘you are here’ or what means.

Briefly, when the results are discussed according to ISO 9241 (2015) standards;

Effectiveness:

During the implementation totally 72 tasks asked to be completed to the users only 4 of them failed. In this sense, it is inevitable to say the interface design is effective, but, it does not mean that the design will not need any improvements, because of the efficiency problem with the Task 6.

Efficiency:

During the implementation, 35,80 % of the total time used for all the tasks was spent on Task 6. Some of the testers attempted to use the keyboard instead of the mouse although it was clearly explained to the testers it is not necessary to use the keyboard for succeeding the task. After the testers experienced the task, during the retrial, the average time spent on this task was measured as 3 seconds. The results show that average of completion time on the Task 6 is 46 seconds. As a consequence, it is not possible to say the interface will pass successfully this evaluation. Indeed, the testers’ verbal reflections give the sufficient outcome the struggle with the efficiency on the task. These reflections also provide data for usability element ‘satisfaction’.

Satisfaction:

The thoughts and feelings that arise during the test of the testers mentioned on ‘Results’ section. The testers aimed to reflect only when problems occurred on the page related to their usability issues. Moreover, during semi-structured interview the testers reflected as ‘satisfied’ with their entire experience. 10 of testers, added their

suggestion about the struggle with Task 6, also ‘icon’ incomprehensibility during the Task 4.

5.1. Limitations and Recommendations

Limitations:

The limitation of the research appeared during data collection processes. In March, 2020 the impact of Covid-19 pandemic was visible in Turkey. Since, the data collection of the research had to begin, though, the implementation was not easy. There were some limitations due to pandemic:

1. As a researcher, as well as an employee of the company, the researcher had to work from home, thus, delayed the collection of data
2. The testers who were planned for implementation, appeared as a subject to mandatory quarantine so the implementation cancelled,
3. Finding an environment for usability testing was demanding, since social distance must be maintained,
4. Testing materials; like laptop, pen and mouse needed to be disinfected and the hygiene had to be ensured between each testers.

The circumstances convinced the researcher to work with less testers and to implement the usability tests by doing over several days.

Recommendations for the workplace e-learning content designers;

It can be concluded that the interface design has some usability problems because of GUI design errors. As a result of the research it is recommended to the designer of the training content to renovate two main features:

1. Replacing icons with more relevant icons
2. Adding a ‘home page’ button to the all pages

In workplace e-learning designs it can be much more practical to find participants for usability testing. The generated content can be assigned to a small group of employees and their experience can be asked via online form. According to reflections of the usability testing; the content can re-designed then, it can be assigned to the target audience. As well as the designer can choose a method similar to the method used in this research. The effective use of working time is important and the content which is the subject of this research causes time to be wasted. This waste of time can be avoided by eliminating design errors.

In general contexts of global e-learning interface design, the fonts should be selected appropriate to the relevant language. The selected fonts should contain language specific characters like ‘ğ, ç, ß, æ’ to keep consistency of the typography, so the native speakers should also check the texts in the content.

Recommendations for further researches:

It is recommended to whom considers about researching the area that; testing the usability of the e-learning together with the system management and the content design. As the e-learning is a whole with the design and the content. If the intention of the researcher, to evaluate the results by quantitative approaches; it is recommended to test the systems and/or the contents with larger groups.

REFERENCE

Acharya, B. (2010). Questionnaire design. *Central Department of Population Studies. Retrieved on: 26-6-2014, at*.

Allen, J. J., & Chudley, J. J. (2012). *Smashing UX design: Foundations for designing online user experiences* (Vol. 34). John Wiley & Sons.

Allen, M. W. (2011). *Designing successful e-learning: Forget what you know about instructional design and do something interesting* (Vol. 2). John Wiley & Sons.

Alroobaea, R., & Mayhew, P. J. (2014, August). How many participants are really enough for usability studies?. In *2014 Science and Information Conference* (pp. 48-56). IEEE.

Arkorful, V., & Abaidoo, N. (2015). The role of e-learning, advantages and disadvantages of its adoption in higher education. *International Journal of Instructional Technology and Distance Learning*, *12*(1), 29-42.

Barendregt, W., Bekker, M. M., & Speerstra, M. (2003, September). Empirical evaluation of usability and fun in computer games for children. In *Proc. IFIP Interact* (Vol. 3, pp. 705-708).

Barolli, L., Koyama, A., Durresi, A., & De Marco, G. (2006). A web-based e-learning system for increasing study efficiency by stimulating learner's motivation. *Information Systems Frontiers*, *8*(4), 297-306.

Bevan, N. Kirakowski and J., Maissel, J. (1991). What is usability. In *Proceeding of the Fourth International Conference on HCI*.

Brna, P., & Cox, R. (1998). Adding intelligence to a learning environment: learner-centred design?. *Journal of Computer Assisted Learning*, *14*(4), 268-277.

Brooke, J., Bevan, N., Brigham, F., Harker, S., & Youmans, D. (1990, August).

Usability statements and standardisation: Work in progress in ISO. In *Proceedings of the IFIP TC13 Third Interational Conference on Human-Computer Interaction* (pp. 357-361).

Cameron, J. (2010). Focusing on the focus group. *Qualitative research methods in human geography*, *3*, 152-172.

Carliner, S. (2004). *An overview of online learning*. Human Resource Development.

Carr, T., Cox, L., Eden, N., & Hanslo, M. (2004). From peripheral to full participation in a blended trade bargaining simulation. *British Journal of Educational Technology*, *35*(2), 197-211.

Chou, C. (2003). Interactivity and interactive functions in web- based learning systems: a technical framework for designers. *British journal of educational technology*, *34*(3), 265-279.

Chou, C. C. (2002, January). A comparative content analysis of student interaction in synchronous and asynchronous learning networks. In *Proceedings of the 35th annual Hawaii international conference on system sciences* (pp. 1795-1803). IEEE.

Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & Sons.

Clemmensen, T., Hertzum, M., Hornbæk, K., Shi, Q., & Yammiyavar, P. (2009). Cultural cognition in usability evaluation. *Interacting with computers*, *21*(3), 212-220.

Crowther, M. S., Keller, C. C., & Waddoups, G. L. (2004). Improving the quality and

effectiveness of computer- mediated instruction through usability evaluations. *British Journal of Educational Technology, 35*(3), 289-303.

Çağıltay, K. (2018). *İnsan bilgisayar etkileşimi ve kullanılabilirlik mühendisliği: Teoriden pratiğe*. ODTÜ Geliştirme Vakfı Yayıncılık.

Dey, I. (2003). *Qualitative data analysis: A user friendly guide for social scientists*. Routledge.

Diah, N. M., Ismail, M., Ahmad, S., & Dahari, M. K. M. (2010, March). Usability testing for educational computer game using observation method. In *2010 international conference on information retrieval & knowledge management (CAMP)* (pp. 157-161). IEEE.

Dillon, A. (2001). The evaluation of software usability. London: Taylor and Francis.

DiMarco, J. (2006). *Web portfolio design and applications*. IGI Global.

Eason, K. D. (1988). *Information technology and organisational change*. CRC Press.

Fallon, C., & Brown, S. (2016). *E-learning standards: a guide to purchasing, developing, and deploying standards-conformant e-learning*. CRC Press.

Fırat, M., Yurdakul, I. K., Ersoy, A., Fırat, M., Kabakçı Yurdakul, I., & Ersoy, A. (2014). Bir eğitim teknolojisi araştırmasına dayalı olarak karma yöntem araştırması deneyimi. *Journal of Qualitative Research in Education-JOQRE, 2*(1), 65-86.

Garrett, J. J. (2010). *The elements of user experience: user-centered design for the web and beyond*. Pearson Education.

Ghirardini, B. (2011). *E-learning methodologies: A guide for designing and developing e-learning courses*. Food and Agriculture Organization of the United Nations.

Grbich, C. (2012). *Qualitative data analysis: An introduction*. Sage.

Gutwin, C. (2020). Effects of Visual Distinctiveness on Learning and Retrieval in Icon Toolbars.

Hammersley, M., & Atkinson, P. (1995). *Ethnography: Principles in practice* (2nd ed.). London: Routledge.

Hartson, R., & Pyla, P. S. (2012). *The UX Book: Process and guidelines for ensuring a quality user experience*. Elsevier.

Hrastinski, S. (2007). *Participating in synchronous online education* (Vol. 6). Lund University.

Hrastinski, S. (2008). What is online learner participation? A literature review. *Computers & Education*, *51*(4), 1755-1765.

Hrastinski, S., Keller, C., & Carlsson, S. A. (2010). Design exemplars for synchronous e-learning: A design theory approach. *Computers & Education*, *55*(2), 652-662

Hartson, R., & Pyla, P. S. (2012). *The UX Book: Process and guidelines for ensuring a quality user experience*. Elsevier.

Hertzum, M. (2020). Usability Testing: A Practitioner's Guide to Evaluating the User Experience. *Synthesis Lectures on Human-Centered Informatics*, *13*(1), i-105.

Hutchby, I., & Wooffitt, R. (2008). *Conversation analysis*. Polity.

ISO (1991) Software product evaluation - Quality characteristics and guidelines for their use, ISO DIS 9126.

ISO 9241-11.(2015). *Ergonomics of human-system interaction-Part*, *11*.

ISP (2004) 'Getting started with e-learning ', last updated: November 2004, isp.webopedia.com/TERM/E/e_learning.html, date visited: October 2020.

Jethro, O. O., Grace, A. M., & Thomas, A. K. (2012). E-learning and its effects on

teaching and learning in a global age. *International Journal of Academic Research in Business and Social Sciences*, *2*(1), 203.

Johnson, J. (2020). *Designing with the mind in mind: simple guide to understanding user interface design guidelines*. Morgan Kaufmann.

Kakasevski, G., Mihajlov, M., Arsenovski, S., & Chungurski, S. (2008, June). Evaluating usability in learning management system Moodle. In *Iti 2008-30th international conference on information technology interfaces* (pp. 613-618). IEEE.

Kanuka, H., & Rourke, L. (2008). Exploring amplifications and reductions associated with e- learning: conversations with leaders of e- learning programs. *Technology, Pedagogy and Education*, *17*(1), 5-15.

Khan, B. H. (2006). *Flexible Learning in an Information Society*: Hershey PA17033:Information Science Publishing (August 7, 2006), USA.

Leuthold, S., Schmutz, P., Bargas-Avila, J. A., Tuch, A. N., & Opwis, K. (2011). Vertical versus dynamic menus on the world wide web: Eye tracking study measuring the influence of menu design and task complexity on user performance and subjective preference. *Computers in human behavior*, *27*(1), 459-472.

Malhotra, N. K. (2006). Questionnaire design and scale development. *The handbook of marketing research: Uses, misuses, and future advances*, 83-94.

Maltz, L., Deblois, P. & The EDUCAUSE Current Issues Committee. (2005). Top Ten IT Issues. *EDUCAUSE Review*, 40 (1), 15-28.

Mathis, L. (2011). *Designed for Use - Create Usable Interfaces for Applications and the Web* (Pragmatic). USA.

Mayadas, F. (1997). Asynchronous learning networks: A Sloan Foundation

perspective. *Journal of Asynchronous Learning Networks*, *1*(1), 1-16.

McKay, E. N. (2013). *UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication*. Newnes.

McNamara, C. (1999). General Guidelines for Conducting Interviews. Minnesota.

Mealy, L., & Loller, B. (Eds.). (2000). *E-learning: Expanding the Training Classroom Through Technology: a Collection of Articles by the Pioneers of E-learning*. Rector-Duncan.

Méndez, J. A., Lorenzo, C., Acosta, L., Torres, S., & González, E. (2006). A web-based tool for control engineering teaching. *Computer Applications in Engineering Education*, *14*(3), 178-187.

Milenovic, Z. M. (2011). Application of Mann-Whitney U test in research of professional training of primary school teachers. *Metodicki obzori*, *6*(1), 73-79.

Nielsen, J. (2012), Usability 101: Introduction to Usability. (Alertbox, 4 January 2012) http://www.nnTroup.com/articles/usability-101- introduction-to-usability.

Pachler, N., & Daly, C. (2011). *Key issues in e-learning: Research and practice*. A&C Black.

Perfetti, C.,& Landesman, L.(2002).Eight is not enough. Retrieved April 14, 2003 from http://world.std.com/~uieweb/Articles/eight_is_ not_enough.htm.

Peters, D. (2014). *Interface design for learning: Design strategies for learning experiences*. Pearson Education.

Pogrebin, M. (2003). *Qualitative approaches to criminal justice: Perspectives from the field*. Sage.

Pollard, A. (2001). *The social world of children's learning*. A&C Black.

Pollard, E., & Hillage, J. (2001). *Exploring e-learning*. Brighton: Institute for Employment Studies.

Preece, J., Sharp, H., & Rogers, Y. (2015). *Interaction design: beyond human-computer interaction*. John Wiley & Sons.

Randolph, J. J. (2008). *Multidisciplinary methods in educational technology research and development*. Hämeenlinna, Finland: HAMK University of Applied Sciences

Raworth, K., Sweetman, C., Narayan, S., Rowlands, J., & Hopkins, A. (2012). *Conducting semi-structured Interviews*. Oxfam.

Reiss, E. (2012). *Usable usability: simple steps for making stuff better*. John Wiley & Sons.

Schegloff, E.A. 1992a. 'Introduction to Volume 1', in H. Sacks (1992) *Lectures on Conversation*, Volumes I and II, edited by G. Jefferson and E.A. Schegloff, Oxford and Cambridge, MA: Basil Blackwell, ix–xii

Siegel, S. (1957). Nonparametric statistics. *The American Statistician*, *11*(3), 13-19.

Shackel, B. (1984). The concept of usability. In J. Bennet, D. Case, J. Sandelin, & M. Smith (Eds.), *Visual Display Terminals* (pp. 45-87). Englewood Cliffs, NJ: Prentice-Hall.

Shahabadi, M. M., & Uplane, M. (2015). Synchronous and asynchronous e-learning styles and academic performance of e-learners. *Procedia-Social and Behavioral Sciences*, *176*(20), 129-138.

Schmidt, C. (2004). The analysis of semi-structured interviews. *A companion to qualitative research*, 253-258.

Soyemi, J., Ogunyinka, O. I., & Soyemi, O. B. (2012). Integrating self-paced e-

learning with conventional classroom learning in Nigeria educational system. *Journal Plus Education*, *2012*(1), 195-203.

Squires, D., & Preece, J. (1996). Usability and learning: evaluating the potential of educational software. *Computers & education*, *27*(1), 15-22.

Spool, J., & Schroeder, W. (2001, March). Testing web sites: Five users is nowhere near enough. In *CHI'01 extended abstracts on Human factors in computing systems* (pp. 285-286).

Tuovinen, J. E. (2000). Multimedia distance education interactions. *Educational Media International*, *37*(1), 16-24.

Van Someren, M. W., Barnard, Y. F., & Sandberg, J. A. C. (1994). The think aloud method: a practical approach to modelling cognitive. *London: AcademicPress*.

Wang, M. (2018). *E-Learning in the Workplace A Performance-Oriented Approach Beyond Technology.* Springer.

Zaharias, P., & Poulymenakou, A. (2006). Implementing learner- centred design: The interplay between usability and instructional design practices. *Interactive Technology and Smart Educatio*