THE COMPARISON OF WEB AND MOBILE INTERFACES OF A
LEARNING MANAGEMENT SYSTEM
IN TERMS OF PERCEIVED AESTHETICS

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ABSTRACT

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A LEARNING MANAGEMENT SYSTEM
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This study aims to inquire the perceived differences in aesthetics of web and mobile interfaces of a Learning Management System (LMS) using an aesthetic measurement inventory named Visual Aesthetics of Websites Inventory (VisAWI) and to further investigate the students' opinions on the effect of these differences on their learning. The data were gathered from a total of 128 university students from freshmen to senior, studying in Middle East Technical University, Department of Computer Education and Instructional Technology. An embedded experimental design was used as the research method. Regarding the data collection instruments, while VisAWI was used for collecting quantitative data, individual interviews were made with 10 students who answered the inventory for gathering qualitative data. Before applying the data collection instruments, in order for students to have the same experiences in the two interfaces they were required to perform the most frequently used features of the LMS, using a pre-set task list. The mean values of each dimensions of VisAWI, i.e. simplicity, diversity, colorfulness and craftsmanship, and the mean value of the overall perceived aesthetics of the learning management system were obtained. In order to analyze if statistical significant differences exist in the aesthetical dimensions scores of students,

paired samples t-test was conducted. Following the quantitative data analysis, a qualitative deductive content analysis was performed on the collected and transcribed interview data. The results of the t-test showed that, while there are significant differences in the simplicity, diversity and craftsmanship aesthetical dimensions between web and mobile interfaces, there is no significant difference in the colorfulness dimension. The overall aesthetics of both web and mobile interfaces of the LMS were perceived better than average. The results of the content analysis on the interview data supported the findings of the VisAWI. Furthermore, students commented that aesthetical components of the web and mobile interfaces had an effect on their learning, motivation, and attention.

Keywords: VisAWI, aesthetics in education, mobile, learning, aesthetic perception, LMS

ÖZ

BİR ÖĞRENME YÖNETİM SİSTEMİNİN WEB VE MOBİL ARAYÜZLERİNİN ESTETİK ALGI YÖNÜYLE KARŞILAŞTIRILMASI

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Bu çalışmanın amacı, bir öğrenme yönetim sisteminin (ÖYS) web ve mobil arayüzleri arasındaki estetik algı farkını, Web Sitelerinin Görsel Estetik Ölçeği (VisAWI) isimli estetik algı anketini kullanarak araştırmak ve öğrencilerin, bu farkların öğrenmeye olan etkileri hakkındaki düşüncelerini incelemektir. Çalışmada kullanılan veriler, Orta Doğu Teknik Üniversitesi, Bilgisayar ve Öğretim Teknolojileri Eğitimi'nde okuyan birinci sınıftan son sınıfa kadar toplam 128 üniversite öğrencisinden toplanmıştır. Araştırma metodu olarak sosyal geçerleme araştırma yöntemi kullanılmıştır. Veri toplama aracı olarak VisAWI nicel veri toplama amacıyla kullanılırken, nitel veri toplama aşamasında ise daha önce ankete katılmış olan 10 kişi ile bire bir görüşme yapılmıştır. Veri toplama aşamasından önce, önceden tasarlanmış görev listesi yardımıyla tüm öğrencilerin iki arayüz üzerine aynı derecede deneyim kazanmaları amacıyla öğrencilerin ÖYS'nin en sık kullanılan fonksiyonlarını kullanmaları sağlanmıştır. VisAWI'de belirtilen sadelik, çeşitlilik, renklilik ve profesyonellik olmak üzere her bir faktörün ortalama puanları ve öğrencilerin ÖYS hakkındaki genel estetik algılarının ortalama puanı hesaplanmıştır. Öğrencilerin her bir faktör hakkındaki estetik algıları arasında anlamlı bir fark olup olmadığını araştırmak amacıyla bağımlı örneklem t testi uygulanmıştır. Nicel veri

analizini takiben, toplanan ve yazıya dökülen görüşme verileri üzerinde içerik analizi yöntemi uygulanmıştır. T testinin sonuçları web ve mobil arayüzlerinde sadelik, çeşitlilik ve profesyonellik estetik faktörleri açısından anlamlı bir fark gösterirken, renklilik estetik faktöründe anlamlı bir farklılık göstermemiştir. Web ve mobil arayüzlerinin her ikisi hakkında öğrencilerin genel estetik algısı ortalamanın üzerindedir. Görüşme verileri üzerinde gerçekleştirilen içerik analizinin bulguları, VisAWI bulgularını desteklemektedir. Buna ek olarak öğrenciler web ve mobil arayüzlerinin estetik faktörlerinin öğrenme, motivasyon ve dikkat üzerinde bir etkisi olduğuna dair değerlendirmeler yapmışlardır.

Anahtar Sözcükler: VisAWI, eğitimde estetik, mobil, öğrenme, estetik algı, ÖYS

I Dedicate This Work to My Family Who Always Supported
and Encouraged Me to Believe in Myself and to Be Aware of
My Limitless Potential.

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LIST OF ABBREVIATIONS

VisAWI   Visual Aesthetics of Websites Inventory
VisAWI-S   Visual Aesthetics of Website Inventory- Shortened
METU   Middle East Technical University
CEIT   Computer Education and Instructional Technology
LMS   Learning Management System
GUI   Graphical User Interface
ISO   International Standards Organization

CHAPTER 1

INTRODUCTION

The first chapter presents the background of the study. Following that, the problem statement, purpose of the study, research questions to be answered in the following chapters, significant of the study and finally definition of the terms are addressed.

1.1 Background of the Study

Education has gone under countless reforms from past to present. Due to the nature of subtler human learning, education has gone through big changes, affected by the theories, inventions, innovations and technologies of the mileage such as integration of computers, Internet, mobile devices, various software, or applications hoping that they contribute to learning. With the integration of new technologies in education some additional factors to be considered should arise in order to eliminate the negative impacts of the integrations in learning and to advance learning using the new material. Following the usage of technologies, the information and all the content presented to the students has shifted onto various sizes of monitors and with different GUI designs. Visual appearance of the design is usually the most underestimated or ignored concept in e-learning. However, design and aesthetics have non-negligible effects on the way students perceive information and learn, analyze credibility and usability, and assign value to an online experience (Reyna, 2013). Furthermore, aesthetic judgment approaches for web page interface are essential for attracting the learners' attention and assembling the students' interest in using the GUI. (Zain et al., 2007) Norman (2002) explains the essential positive influence of the aesthetics on cognitive system and competence in problem solving by causing an emotional arousal. There are a number of studies concluding that

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aesthetics facilitates achievement especially in the sense of problem solving tasks whenever the problematic task is challenging (Moshagen et al., 2009; Reppa & McDougall, 2015). On the contrary, Douneva et al. (2015) explains that there is no significant impact of a less aesthetically pleasing communication tool on the collaborative team performance. Despite the contradictions, majority of the studies reports the positive effects of aesthetics on performance and it is reported that the contradiction might be due to other environmental factors while measuring the performance (Douneva et al., 2015). Educational web interfaces designed for big screens including computer monitors were and are still very popular and are used in a widespread manner. Rapid development and change of mobile devices especially cell phones have also became an indispensable part of daily life including educational areas. Quite large number of research has been conducted on design principles, and standards in order to facilitate usability and aesthetics of commercial user interfaces, yet fewer studies have concentrated on the issue in the sense of educational interfaces. Usability and aesthetics of a user interface are both said to be very crucial in facilitating educational achievements but until recent years, aesthetics of the websites has been ignored and underestimated while the usability was given so much care. The latest definition of usability for web interfaces has been defined by ISO as: "the capability of the software product to be understood learned, used and attractive to the user, when used under specified conditions." (Bevan, 2001). As the definition of usability suggests, an interface should be attractive to the users as well as being effective and efficient in terms of functionality. In such a visual period, it would not be enough for the users to gather a user interface, which solely concerns functionality. Especially in education, motivating students and attracting attention on the lesson has always been a challenging issue.

After adaptation of daily life technologies into education, it may become a hard task to keep the students' focus on the lesson unless the instructional technologies are emotionally arising, and aesthetically pleasing. There are numerous work and emphasis on positive impact of perceived aesthetics and visual pleasure on user behaviors (Lavie & Tractincsky, 2004). It is obvious that in recent years, the tools

and software commonly used in daily lives are highly visual, and aesthetically pleasing as well as highly usable. Therefore, students need and look for the same emotionally pleasing interfaces also in the educational materials, which results in changing their behaviors. Positive emotions that are arisen from looking at an aesthetically pleasing material are studied for their contribution to advance learning (Plass et al., 2014). Research have investigated the effect of positive emotions on the memory and stated that the positive emotions assist as hints for retrieving the information from long-term memory (Isen et al., 1987). Although perception of aesthetics seems to be a subjective issue, Moshagen and Thielsch (2010) developed an objective aesthetic measurement that can actually measure the aesthetic perception of users based on some common aesthetical sensations. Although there may be a common understanding of aesthetics, exact same aesthetic design of a website can awake different perceptions on different devices. Therefore, it is really important to consider different aesthetic designs for different devices in an educational setting. There are several aesthetic measurements that are defined by the researchers. Many of these measurements are based upon the basic design principles including color, balance, simplicity, equilibrium, symmetry, density. An Aesthetic Measurement Application is developed to measure aesthetic values of websites (Zain et al., 2007). Lindgaard et al. (2006), Lavie and Tractinsky (2004), proposed aesthetic measurements based on similar design elements.

Reyna (2009) focused on color scheme, symbols used in the web design, and typography. Most of the measurement tests include subjective opinions of the participants, hence their validity is not approved and the error rates of the analyses would be significantly high. The most commonly mentioned aesthetic dimensions were collected under 4 categories with a total of 18 questions to measure perceived aesthetics and named as VisAWI by Moshagen & Thielsch (2010) and three years following the VisAWI was proposed, a short version of the same measurement named as VisAWI-S was suggested. Unlike the measurement developed by Lavie and Tractinsky (2004) that is composed of two dimensions, the VisAWI focuses on a total of 4 dimensions including simplicity, diversity, colorfulness, and craftsmanship

for measuring aesthetics of a web interface. Both of the instruments to measure aesthetics provide a reliable and valid aesthetic measurement. (Hirschfeld & Thielsch, 2015).

1.2 Statement of the Problem

Recently, there is a rapidly growing trend of using user-interfaces for educational purposes in many areas of the study. From e learning, to classrooms, which the instructional technologies are integrated into teaching and learning, a GUI design is required. The interfaces provide various opportunities in education by reducing the cost of education including finance and time, contributing to cognitive system, memory, learning and problem solving with the help of the content they present and with the help of how they present it. Let aside the content, many researchers have concluded that the design and aesthetics of a user interface itself lead to significantly positive outcomes on the performance and learning by stimulating the positive emotions. Causing an emotional arousal affects the way of thinking in either a positive or negative way. Beauty of the design has an essential impact on increasing the commitment of students, attracting the attention on the critical points, as well as providing another medium of communication (Reyna, 2013). Despite all the mentioned studies of positive impacts of the aesthetic design on learning, Garner, Harp, Lehman, Lenzer, Mayer, and Rey argued that the elements in a design can cause an additional cognitive load and can worsen learning (Heidig et al., 2014). Based on the mentioned studies, it is certain that the visual design should be given as much care as usability for it to advance learning rather than worsening it. A learning material presented both for web and mobile should be evaluated separately in terms of aesthetic appearance, as the same elements and aesthetic dimensions may not evoke the same emotions on the students. It is very crucial for preventing a design causing extraneous cognitive load on students, which will harm learning. Plass et al. (2014) explained that introducing a beautifully designed learning material activates positive emotions, hence advances comprehension. Similarly Um et al. (2012) provided results supporting that the positive emotions that the users evoke with the

help of visual design facilitated the comprehension and transfer of knowledge performances. Additionally, the students who were exposed to a beautifully designed interface have perceived the materials and provided more mental engagement and motivation and satisfaction during the educational task (Plass et al., 2014). In order to benefit from the user interfaces designed for education, the visual pleasure that they evoke on learners should be evaluated very carefully for different settings. A really good looking, and aesthetically pleasing learning content that is presented on a web screen may not evoke the same emotions when it is presented or adapted in a mobile device screen, which may have a significant impact on the students' preference of learning material, cognitive system, learning, motivation, or satisfaction.

As many regular mobile device users know, there is quite large number of limitations of a mobile device. Due to these limitations, designing a good user interface is not an easy job. As the screen sizes, data entry methods and external tools such as stylus used for mobile devices are different from that of a computer or any other bigger device, perceived visual aesthetics of a user interface will differ as well. So as to design a usable and satisfying mobile user interface, mobile domain specific constraints should be taken into consideration, as the usability and visual appeal have a significant impact on learning.

1.3   Purpose of the Study

Purpose of this study is to investigate the differences between the perceived aesthetics of the web and mobile user interfaces of a learning management system that is used in Middle East Technical University- named ODTUCLASS, investigate the students' overall aesthetic judgment about the learning management system, understand the effect of aesthetics of the user interface of a learning management system on their learning, and contribute to the very limited literature about the perceived aesthetic values of different sizes of interfaces. The reason why ODTUClass was preferred in the study is that, it would be much more convenient to

collect data from the participants who have almost equal experience and interaction with the user interface, so that the perceived aesthetic would not be affected by the usability related issues.

In a more organized manner, the aims of the study are listed as follows:

- To determine the differences between perceived aesthetics of mobile version of a learning management system called as ODTUClass used in Middle East Technical University, and the web version the same system.

- To explore the perceived aesthetics of the overall LMS user interfaces designed for web and mobile screens.

- To understand students' opinions about the relationship between visual aesthetics of the interface design and learning.

1.4   Research Questions

Throughout the study, the following research questions were addressed:

Research Question 1: Is there a difference between students' perceived aesthetics of web and mobile interfaces of the LMS with regard to the Visual Aesthetics of Websites Inventory (VisAWI).

Sub-Questions:

R.Q.1.1. Is there a significant difference in perceived simplicity dimension scores of web and mobile interfaces?

R.Q.1.2. Is there a significant difference in perceived diversity dimension scores of web and mobile interfaces?

R.Q.1.3. Is there a significant difference in perceived colorfulness dimension scores of web and mobile interfaces?

R.Q.1.4. Is there a significant difference in perceived craftsmanship dimension scores of web and mobile interfaces?

Research Question 2: What are the overall perceived aesthetics of web and mobile interfaces of the LMS?

Research Question 3: What are the students' opinions about the effects of visual aesthetics of the LMS on learning?

Exploring these research questions will lead to a clear differentiation for user interfaces of web and mobile screens in terms of aesthetics. This way, the mystery about whether the aesthetic design principles of a mobile device can be put in the same equation with the web interface might be clarified. Moreover this study might shed light to future studies about focusing on the differences between perceived aesthetics of user interfaces designed for web and mobile screens.

1.5   Significance of the Study

The main purpose of this study was to investigate the possible differences between the perceived aesthetics of one single visual design of instructional content in two different platforms: web and mobile screens. There are studies in the literature providing initial evidence that the aesthetically pleasing user interfaces evoke positive emotions and hence trigger the motivation to engage in the task with a greater mental effort and learning. However, it is not possible to claim that whenever the aesthetic design of a user interface on web is perceived high and evoke positive emotions on learners will be perceived the same way when it is adapted to the mobile screen. The same colors, the same font styles, or the same layout used for mobile screen may evoke a negative emotion on the learner when presented in web screen or vice versa. Discriminating the aesthetic judgments of learners between two different devices is crucial to determine the likelihood of a need for different aesthetical design principles or aesthetic dimensions specific for the mobile screens. In addition, this study aims to highlight the importance of aesthetics in learning and cognitive

system. Although aesthetics has been taken into account very seriously in most of the business websites, it's often neglected to employ a visually pleasant design in the educational websites (Hartmann et al., 2008). For less than a decade, the visual value of the e-learning course page designs has started receiving deliberation (Phongsatha, 2008). Although Clark (2005) states that there is uncertainty and controversies in the literature about the impact of aesthetics on motivation or learning, Phongsatha highlights that considerable time and resources are spent for the cosmetic values of the learning user interfaces.

There is evidence that the decision-making and preferences of people are influenced by the aesthetic appearance of products, while there is not enough study in the literature to verify whether the aesthetic values of the web based learning media also influence the decision-making and preferences of students. This study will investigate the effect of aesthetic perception differences of students on their preference of the media that the learning material is presented, and to understand learners' opinions on the effect of aesthetics on motivation and learning. There is insufficient number of study on the literature about the aesthetic design differences between a larger screen and a smaller screen; whether the smaller screen should have different aesthetic design principles, do the same visual design principles can be assumed as valid for all the screen sizes, or whether the students perceive the identical design principles the same way in both of the screen sizes. However, if there are aesthetic perceptional differences between different screen sizes, separate design principles of aesthetic dimensions might be required for mobile screens. On the other hand, if the aesthetic perceptions are found to be dependent on the type of screen, instructors might change their device preferences, in order to improve efficiency. Finally, e-learning and mobile learning still do not have a clear differentiation on people's minds, aesthetic approach is cut out for understanding the difference between using web user interface and mobile user interface for educational purposes. When the instructors and students can understand the difference between using web and mobile interfaces, their device preferences might

be more on point and hit the bull's eye regarding to the nature of each different learning activity, which might enhance the effectiveness of the course material.

1.6   Definition of Terms

Graphical User Interface: A program that is designed for easing the communication and interaction between the human and the computer by utilizing the computer's graphical and visual capabilities.

Moodle: A learning platform that is designed for the course management purpose.

Learning Management System: Software for the administration, documentation, tracking, reporting and delivery of electronic educational technology (also called e-learning) courses or training programs. (Ellis, 2009)

Aesthetic Perception: The philosophical theory or set of principles governing the idea of beauty at a given time and place: the clean lines, bare surfaces, and sense of space that bespeak the machine-age aesthetic; the Cubist aesthetic. (n.d., dictionary.com)

ODTUClass: A Moodle based course management system that is redesigned uniquely for Middle East Technical University.

Cognitive System: Mental system consisting of interrelated items of assumptions, beliefs, ideas, and knowledge that an individual holds about anything concrete (person, group, object.) or abstract (thoughts, theory, information.). (n.d., Business dictionary)

Learning: Measurable and relatively permanent change in behavior through experience, instruction, or study. (n.d., Business dictionary)

Learning Medium/Media: Teaching or learning tool.

E-Learning: E-learning is learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom. (n. d., Elearningnc)

Design Principle: The principles of design are intended to improve the quality of a design.

Emotional Arousal: The arousal of strong emotions and emotional behavior

Simplicity: An aesthetic principle that refers to the stylistic beauty concepts such as unity of the elements, homogeneity, clarity, orderliness, and balance of the user interface, hence it is the cornerstone for formalizing the aesthetic value.

Diversity: An aesthetic concept that refers to the unity and harmony in the diverse elements of the user interface design.

Colorfulness: The aesthetic principle that explains how pleasant the color preference, color composition and combination of the user interface is designed.

Craftsmanship: An aesthetic principle that can be characterized with the sophistication, and professionalism of the user interface.

CHAPTER 2

LITERATURE REVIEW

The second chapter presents the literature serving as a theoretical foundation for this research. Majority of the studies in the literature are about the issue of usability and aesthetics on a larger screen design, but the widespread use of mobile devices in every area of daily life including education has shifted the need of research towards mobile user interface design in education. It is unlikely that the visual design for the mobile devices that are naturally different can aesthetically be perceived the same way as a larger web screen. Although the layout, color preference, and other design dimensions are kept constant both for web and mobile screens, the user may not perceive them the same way.

With the rapid increase in popularity of the computers and mobile devices as being part of life's rich pageant, integration of these devices in various sectors and branches of sectors has been inevitable. The integration has led to a rapid change in perceptions and habits towards the learning materials. Traditional instructional materials including books, lecture notes, even the assessment tests including paper-pencil test have yielded to the soft versions of course materials, lecture notes, and exams. The great shift of the regular practices in education towards the online environment has shed light to some concerns and issues about the effects of the user interface designs on the learners. The effect of usability especially for the computer screen-specific interface on learning has taken seriously the most. Shacklett (2001) states that organizations have noticed that the existence of a Website cannot ensure driving traffic to the website. Nielsen (2012) discussed the importance of usability on survival of the website and the ways to improve it. Crowther et al. (2004) researched the positive effect of usability testing on learning effectiveness for the computer

based chemistry course. Davids et al (2014) focused on the effect of usability testing on learning in the concept of multimedia e learning and emphasized the importance of usability by reporting that doctors who could not be able to complete first task were not allowed to engage in the second case "Hands On" where majority of significant learning was going to be occur and only 20% of doctors could complete both tasks due to usability problems in the first case. Kakasevski et al. (2008) focused on the usability of the most commonly used learning management system Moodle and concluded its major usability issues which may affect education.

Following the usability, visual appearance of the websites has been the other crucial factor for attracting the visitors. By focusing on the general design principles, the designers have competed to come up with each other by increasing visual appeal of the interfaces. Especially in business and commercial areas, aesthetics became a very powerful determinant of user preference in the competition among designers. Kallio (2003) discussed the effect attractive interface on decision-making process concluding that a pleasant user-interface evokes positive emotions and changes the "somatic state" to enjoyment mode and the decision that will be made will be based on the positive thrill. Shun et al. (2008) researched the effect of interface aesthetics on consumers' online purchasing behavior and concluded that expressive aesthetics would directly influence consumers' affect state and closely relate to enjoyment in the shopping process. Salimun et al. (2010) studied the effect of aesthetics on visual search performance, reporting that the search performance was strongly affected by

Miniukovich and De Angeli (2014) studied the perceived complexity of the website appearance and aesthetics of the user interface designed for mobile devices. The results illustrated that participants assessed the aesthetics of user interface the same way as widescreen website interfaces and judged by their visual appearance.

Assessing the aesthetical perception of users can be considered a subjective point of view, yet the studies in the literature shows that there are aesthetic dimensions for making an objective visual measurement is possible. All reviewed research in this chapter is related with the effect of aesthetic design in learning and student

motivation, the aesthetic dimensions and the design principles, and several aesthetic measurements. The literature is categorized under five main titles: Importance of Aesthetics in User Interface Design, Effect of Aesthetics on Learning and Motivation, Mobile User Interface Design, Visual Design and Aesthetic Dimensions, and Measuring Perception of Aesthetics.

2.1 What is Aesthetics?

The concept of beauty lays back to the ancient centuries. Hoyer and Stockburger-Sauer (2012) state that the roots of the word aesthetic derive from "aisthetikos" in Greek language that refers to the perception of sense. Aesthetics also is used for describing beauty. Stich (2004) adds one's "sensitivity to the beautiful" in the definition. Other researchers usually described the term as pleasant taste. (Berlyne 1974a; Child 1964; Frith and Nias 1974; & Goetz et al. 1979). Aesthetics, from the beginning of its existence, was open to discussions about its subjectivity and objectivity. The academy perceived the aesthetics as a subjective concept until very recent years, however there are researchers who found objectiveness in the beauty.

Holbrook (1981), Charters and Pettigrew (2003). Ferry (1993) also supported the idea that the subjective taste might have objective dimensions. Similarly Solomon et al. (1984) stated that the aesthetic criteria could be objectively determinable.

Lavie and Tractinsky (2004) came up with two dimensions of aesthetics, which are classical and expressive aesthetics. The classical aesthetics were defined as the dimensions related with the figural beauty, which refers to clear and orderly design, while the expressive aesthetics characterize the creativity, sophistication, and originality of the design.

Latter researchers focused on these two dimensions and designed an aesthetic measurement called Visual Aesthetics of Websites Inventory which combined simplicity of the design, diversity, colorfulness and craftsmanship as the determinant dimensions of overall aesthetics of a user interface.

2.2 Aesthetics in User Interface Design

In the visual design literature importance of aesthetic design in various areas are highlighted, yet not many studies approached the issue from the point of education and learning. Reyna (2013) explained the intellectual effect of visual aesthetics of e-learning user interfaces on the perception of information, learning and fidelity of users to the website. Jin and Boling (2010) mentioned the probable assets of visuals on learning. Kress and Leeuwen (1996) described aesthetic literacy as a "visual grammar" combined of dots, lines, shapes, colors, textures, and tone and associated the effectiveness in reading and understanding with the learner's interaction with visual grammar. Metros (2008) argued the need for integration of visual literacy in curriculum so that the multi modal learners will be able to receive guidance from visuals and images for decision making; as well as understanding, anticipating, and creating.

Because visuals and aesthetics of objects and web designs have so much potential on people's reactions and feelings in the 21st century, it can be used effectively in the educational settings contributing to student's learning. Although the attempts of integrating technologies with GUIs have already being made, the effectiveness of their design should be discussed.

Gait (1985) drove the significance of aesthetics. The new wave that highlights aesthetic started to scatter and received support by many other researchers. Lavie and Tractinsky (2004) drew attention to aesthetics and visual appeal as the integral part of interactive systems designs. Alben (1996) states that the visual appeal is an essential element of an efficient and effective interaction design. Green and Jourdan (2000) and Norman (2002) argued that excessive emphasis on functionality and user performance issues blocked the attention on the dimensions including aesthetics that advocate contentment in contemporary design.

According to a study conducted by Schultz (2005), aesthetical graphical design elements in a website have shown a positive impact on perceived usefulness and impressions on the website although it was not tested on mobile user interface.

Cyr et al. (2006) mentioned in his study that there is a correlation between the beauty of a user interface and the developed e-trust by the users. Mottus and Lamas (2015) discuss aesthetic measurement models that enable using objective assets for presuming perceived aesthetics of a user interface. According to Mottus and Lamas, interaction design can have more aesthetic dimensions to measure than the previously proposed methods such as sound. Interaction aesthetics has been defined in the study as the "products that are beautiful in use". Unlike aesthetics of appearance, aesthetics in use refers to the perception of users that moves towards a positive impression throughout the interaction process with the interface.

It is obvious that aesthetic solely will not be sufficient enough to provide most wisely designed user interface, yet the studies highlights the positive effect of aesthetics in many dimensions of a good quality user interface design.

2.3 Effect of Aesthetics on Learning and Motivation

As Lin and Boling (2010) states, many instructional designers including Clark and Lyons (2004), Lohr (2003), and Mayer (2001) point out the possible positive effect of beauty on the cognitive process. Study of Reppa and MCDougall (2015) also illustrates that the aesthetic appeal can influence the performance in a positive way. Miller (2011) has brought the positive impact of aesthetic on cognition to light with a mixed method research design. He proposed two e-assessment interfaces that one is superior in terms of aesthetic enhancements. Results of the quantitative study illustrated that aesthetically more pleasing interface reduced the cognitive load of the participants substantially and enhanced the participant satisfaction, eagerness for further use of the interface, volitional self-assessment time, and task performance. Qualitative data has also supported these quantitative outcomes. From past to

present, many studies on emotions and user experience propose that visually attractive objects have explicit impact on emotions and they expedite enhanced curiosity, artistry, and decision-making intelligence by enlightening thought process, eventually promoting learning. (Norman, 2004; & Erez & Isen, 2002). There are many other studies that imply the positive effect of beauty on learner experience, cognition, and learning. Positive evidence suggests that attractive stimuli can improve performance efficacy. (Moshagen et al., 2009; & Sonderegger & Sauer, 2010). Considering all these studies, utilizing the effect of beauty on aesthetic perception of users can trigger performance on learning, problem solving, discovery, and many other outcomes. Learning experiences have quite a large number of qualities other than aesthetic ones. These qualities include emotional, social, cultural, political, and aesthetic. According to Parrish (2009), the aesthetic qualities are designed to endure the meaning of the learning experience. Hokanson et al. (2007) blame instructional designers for not considering the aesthetic potentials. Hamdani et al. (2012) emphasize that this issue is very important that researchers claim learner's engagement to the course, learning experience, and aesthetics are interrelated and should be considered in the instructional design.

Isen and Reeve (2006) found that the positive affect encourages the people to manage the important work as well as the enjoyable task. Study showed that the people with positive affect took responsibility to finish the important task by reducing their time on the enjoyable task. Erez and Isen (2002) also found that the emotional states affect the working memory and information retrieval positively. Fredrickson (2003) investigated the history behind the survival of positive emotions in the evolutionary process of human being and concluded that the positive emotions helped our ancestors to accrue personal resources and to develop intellectual skills which later served as greater odds of survival, while the negative emotions like anger, fear and disgust contributed to overcoming threats and danger in the environment. Isen and her colleagues studied the influence of positive emotions on learning and performance for 20 years and found that the positive emotions helped their thinking become more creative, integrative, flexible, and open to information

(Fredrickson, 2003). Based on the literature, it can be concluded that the positive emotions that the aesthetics of a learning material evokes promotes improvement of cognitive and intellectual skills, motivation, and performance.

Duh and Krasna (2009) states that aesthetics is not only required for visual pleasure, but also for the integrated education where high quality of information transfer is needed. Instructional design aims the efficient use of media for educational purposes and the media needs to be designed very carefully so that the information transfer will be as much effective as possible. Integrating e-learning technologies -like learning management systems- in ID is a common behavior. Nielsen (1994) permitted that he was not able to encourage himself to learn to use an unappealing spreadsheet application. There is considerable information that images, graphics or visuals play a critical role in learning (Hiebert, 2009). Student engagement and comprehension of conceptual information is enhanced when visual content is presented to them. (Glore, 2010; Vaughn et al., 2009; Scribner, 2007; Margueratt, 2007; Huett, 2006; Anglin et al, 2001).

Moshagen et al. (2004) examined that high visual aesthetics advances user performance under the condition of poor usability, consequently compensates the usability problems. On the other hand results also showed that aesthetics has no major effect on the perceived usability and aesthetics itself cannot guarantee the best performance.

Hallnäs and Redström (2002) suggest that it is the evoked emotions of users what establishes the presence of everyday computational things. The study discusses the power of aesthetics on the behaviors of users in terms of accepting the computational materials in their lives. It is clearly underlined in the study that emotional triggers such as aesthetics, art, sounds, colors, and memories cause the feeling of presence in the user. Aesthetic dimensions are one of those emotion stimulators that might cause the acceptance or presence. In education it is crucial for the learners to embrace and internalize an educational material; hence, creating a user interface that triggers emotions of learners through its aesthetic appeal is a crucial requirement.

Silvennoinen et al. (2014) stated that the aesthetics in technological devices evoke emotions and emotional responses. Results of the study illustrated that the aesthetics of a user interface plays an important role on the user experience.

2.4   Mobile User Interface Design

It could not been clarified certainly how the web and mobile screens should be designed so that their visual beauty will be perceived almost equally since the early 2000's. Gong and Tarasewich (2004) stated that how the design of the user interfaces developed for mobile screens is unproven and mystery, while there are a myriad of successful studies in developing design guidelines for web screens. They modified the existing design rules as well as proposing new mobile-specific design guidelines so that they could be applicable to the mobile versions of the user interfaces. Gon and Tarasewich also emphasized the aesthetics as playing a role on pleasing user experience with mobile devices. Together with the rapidly increasing popularity of mobile devices, various user interface design approaches have been suggested for mobile screens. Due to an unstandardized screen size and features, the issue has been a challenge and various approaches advanced over the others over time. There are a number of discussions on the issue whether the design should be an adaptive, responsive or m-dot design/ mobile-specific design/mobile application. M-dot design is mainly the user interface design that is specific to one type of mobile device and not adaptable to other mobile devices and other sizes of screens. (Cyr, 2015). Cyr explains the responsive design as being the user interface design approach that fits the same content and presents the same content by adapting the layout and margins to the variety of different screen sizes so that the content consistency is preserved and only one design is enough for presenting the content across all the devices. Adaptive design however performs based on the device type rather than the screen size. Although the adaptive design is similar to the responsive design in terms of adjusting the content based on screen size, it can also develop elements such as

buttons, menus, and layouts specific to each device such as iPhone buttons, or Android navigation bars (Ramanathan et al, 2014). Each design approach has its advantages and disadvantages, yet in recent years, due to the release of variety of mobile devices with a number of different screen sizes, m-dot designs have lost their popularity (Cao, n.d).

Nielsen and Norman Group investigate the user interfaces in deep, and contribute to the literature with research findings about the issue as well as guidelines and frameworks for effective and well-designed user interfaces. Based on a long period of investigations, Buidu (2016) treats the advantages and disadvantages of responsive design by comparing it with the mobile-dedicated design. The author states that although the responsive design supports a variety of different devices with different screen sizes, it cannot perform effectively when the tasks and contents are complex. Moreover, the responsive design usually tends to function slower when compared to mobile dedicated designs due to the fact that exact content in the web version is directly transferred to fit in smaller screen sizes.

On the contrary, Sheil (2015) have suggested that choosing responsive design for a learning management system has a lot of advantages. He stated that instead of dictating learning, the LMSs are used for facilitating and enhancing learning, recently. He claims that responsive design provides the users an opportunity to visualize the content with minimal resizing and scrolling.

Leh (n.d.) favors responsive design for the LMS over a mobile application due to several advantages such as reducing the cost of adaptability and the work load on testing the functionality of the design, and it is a guarantee that the design fits in the screen of any size and any device. On the other hand, mobile applications have their advantages of providing extra features such as touch and whipping technology, optimizing and minimizing the elements of the design.

Similarly; other researchers also aggrandize the responsive design instead of m-dot designs or mobile applications due to the lower cost of maintenance, consistency, adaptability on numerous devices, higher user-experiences, wider device support,

speed, reducing the focus on device and increasing the focus on content (Mekadovic, 2016; Cao, n.d; Mellas, n.d.; Naseer, 2013; Stapleford, 2013; Schmitz,2014).

2.5   Visual Design and Aesthetic Dimensions

User interface design has shown a rapid increase aligned with the popularity of online materials including educational websites, business websites, or entertainment applications (Cyr et al, 2006).   Because of the ever-growing number of applications or websites that are presented for the users' taste, visual design of the interface has become extremely important for their competition with the opponents (Venkatesh & Ramesh, 2002). Other research suggests that visual design is also very crucial for the survival of those websites as the study shows that the sensory experience that a user has on the website determines whether the user will stays on the website, or does online shopping (Cai et al, 2008). In most of the studies visual design of the any kind of interface includes similar dimensions of aesthetics. User Interface Design usually includes similar dimensions such as balance, emotional appeal on the user, or aesthetic of the interface, which can be extended into branches of other dimensions such as color, shapes of the objects, typography, sounds just as music or animations (Cyr et al., 2006). Lavie and Tractincsky (2004) related the visual design of the interface with the general design principles of the usability literature. According to the researcher, the visual dimension of the interface is related to clean, orderly aligned, pleasurable and symmetrical design dimensions. There are other studies in the existing user interface design literature that shows evidence that the color can be used as a powerful visual design factor (Hartmann et al, 2007). Bradley (2014) discussed the Gestalt principles in detail in order to explain the recently accepted design principles. Similarly, Lim et al. (2007) proposed attributes for designing aesthetic interactions by adopting the gestalt principles. It is stated that aesthetics was very important for fulfilling the whole experience.

González et al. (2012) studied the aesthetic metrics for the graphical user interfaces. In order to measure the aesthetics of a GUI, visual dimensions such as "balance, linearity, orthogonality, sequentially, and regularity" were taken into consideration. Hartmann et al. (2007) proposed a framework for measuring the overall quality and aesthetics of the user interfaces, which is composed of content, aesthetics, usability/navigation, reputation, and customizability.

Lavie and Tractinsky (2004) have developed an aesthetic measurement instrument abbreviated as "MIPVA" for any sort of user faces, which branches the visual perception into two different types of aesthetics: "classical aesthetics" and the "expressive aesthetics". The researchers have combined the five sub-dimensions under each aesthetic type. The design dimensions "clear, clean, aesthetic, symmetrical and pleasant" are measured under the classical aesthetics while the "original, fascinating, sophisticated, creative and uses effects" are measured under the expressive aesthetics (Heidig et al., 2015). Mottus and Lamas (2015) defined the aesthetic dimensions in a user interface as "visual", "sonic", and "touch". Color has also been considered on development of the visual aesthetics of websites inventory (VisAWI) as a visual design dimension. Together with the color, simplicity, alignment, symmetry, density, white space, layouts, proximity of the objects are also well known in the usability literatures as being a visual design factor. Lamas et al. (2013) focuses on the horizontal or vertical alignment of the objects while studying their perceived visual aesthetics. Unlike to the aforementioned studies, color, lightness, and shape of the objects that the weight of the objects presented on the user interfaces is highly dependent on.

Maldenbrot (1977) discovered that aesthetic perception of human seeks visual resonance and natural fractal shapes. Osinska et al. (2015) points that the human were exposed to only the natural fractal shapes throughout the evolution process while living in savannahs or the forests, which makes the round shapes perceived more sympathetically.

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2.5.1 Simplicity

Simplicity is considered a dimension of classical aesthetic which mainly concerns about the figural beauty of the user interface elements. (Moshagen & Thielch, 2010) Birkhoff (1933) and Eysenck (1941) give importance to the dimension as they consider it as the cornerstone of the aesthetics. Reber et al. (2004) focuses on the dimension from the perspective of information processing approach. It is claimed that the simple designs help users to process information more fluently. Lavie and Tractinsky (2004), Ngo. et al. (2000), and Thielch and Hirshcfeld have also conducted studies on the value of simplicity as an aesthetic dimension.

Reinecke et al. (2013) stated that an important concern caused by the small screen size of mobile devices, which is visual complexity, appeared as an adverse impact on aesthetic perceptions of the users in the study. Although the suggested measures and approaches in the literature were sufficient enough to help us evaluate the usability and to some extend aesthetic appeal, the resources on the mobile user interface aesthetics were discussed very rarely.

2.5.2 Diversity

Diversity dimension does not have to represent the dynamic and creativity of the user interface but the degree of diversity is perceived better and has been given value by the user. This dimension refers to the harmony of varied objects or elements that are present in the user interface. Fechner (1876, p. 39) stated that the cornerstone principle of aesthetics was the "right combination of diversity in unity."

Birkhoff (1933) and Eysenck (1941) focused on the effects of both simplicity and Diversity in order to explain their relationship with the objects. The researchers stated that together with the simplicity, the diversity dimension shows similarities with the Fechner's (1876) description of "unity in density".

The diversity dimension represents "dynamics, novelty, and creativity". One of the psychobiological theories on the visual beauty points that the complexity and novelty are connected variables that cause the emotional arousal. Usually, an interface that is designed simple is labeled as boring, and not inventive because the body naturally seeks for high arousal. Hence, whenever the design is simple, the perceived aesthetics towards the interface might be negative due to the low arousal level.

Diversity neutralizes the low arousal level caused by the simplicity which is highly expected in a highly aesthetical design (Hekkert and van Wieringen, 1990; & Hekkert et al., 2003) and therefore it accepted as a significant aesthetic factor by Lavie and Tractinsky (2004), Haig and Whitfield (2001), Pandir and Knight (2006), and Tuch et al. (2009).

2.5.3 Colorfulness

Color has been considered as having an effect on the people's perceived aesthetics for a long time. The effect of color on the people dates back to the beginning of 40's. Goldstein (1942) proposed a theory getting influenced by the color categorization of Goethe, saying that the colors causes emotional and physiological responses on the body and the state of change results in manipulating the evoked emotions of people, their cognitive attention, and motor skills. Soldat et al. (1997) has exemplified the evoked emotions that the color caused by stating that the red color is associated with happiness. A contrary research shows significant results providing initial evidence that red evokes the feeling of alert, and warning. Results of the study proved that the red color affects the competitors of combat sports who were wearing red sportswear were superior to the ones wearing blue sportswear in the combat competition although they had the similar physical abilities (Hill & Barton, 2005). Shneiderman (1998) offered color use guidelines particularly for the design of mobile user interfaces. Whitehead (2006) determined the color as a usability measure metrics and focused on the importance of usability rather than aesthetics, yet emphasized that

user satisfaction is a part of usability metrics although it is a quite wide term in terms of meaning as user satisfaction is affected by perceived aesthetics of a user interface.

There are a great number of studies about the color and its measurements. Some researchers focus on the color temperature, saturation, or contrast, while some others try to look for evidence that the colors evoke positive or negative emotions. It is long known that there are certain colors that cause some specific emotions. Research illustrates that students being exposed to the red color before taking a test has a negative effect on the achievement (Lichtenfeld et al., 2007; Maier et al., 2008; Elliot et al., 2007). Richardson et al. (2014) made recommendations for instructional web designs such as preferring a text color that contrasts with the color of the background for enhancing legibility. Feisner (2000) emphasized the power of color in triggering psychological information and controlling the observer's responses and attitudes. The study conducted by Coursaris et al. (2008) investigated the effects of color temperature and gender on the web aesthetics, yet the results gathered from the study could not be generalized due to the cultural and personal differences.

Different colors can change the appearance of anything entirely and different colors have different underlying meanings. Um et al. (2012) have conducted a study in order to shape the emotional effect of the materials. The visual design dimensions that were studied included most common visual design dimensions: color, and shape.

Reinecke et al. (2013) approached to perceived aesthetic appeal of a website from the users' first impressions on aesthetics based on visual complexity and colorfulness. Study illustrated that aesthetic perceptions are negatively related with the virtual complexity and colorfulness of the website plays a minor role on perceived aesthetics.

2.5.4 Craftsmanship

Craftsmanship represents the sophistication, professionalism, and skillful integration of all relevant design principles. The dimension is considered as one of the most important dimensions in order to understand the aesthetics of a user interface. Craftsmanship is indirectly related with the usability and there are a plenty of studies emphasizing that usability plays an important role on aesthetics and vice versa. Hekkert and van Wieringen (1990) mentions about the prototypically dimension of aesthetic object. Papachristos et al. (2005) relates the perceived aesthetics of the user interface with the sophistication of the interface.

2.6   Measuring Perception of Aesthetics

Although the importance of aesthetics is broadly discussed, a much more important concern needs to be dwelled on: "how do we decide whether user interface is aesthetic or not". There are several methods to assess aesthetics of a user interface. Kim et al. (2003) points out 30 adjectives that were used in aesthetic measurement and were selected among 278 different emotional adjectives in his study. While preparing the questionnaires, wording of emotions plays a significant role and Kim et al. (2003) joined 30 adjectives into the aesthetic measurement instrument.

Moshagen and Thielsch (2013), developed a measurement for visually pleasing user interfaces and in his next study, he shortened the visual aesthetics of websites inventory (VisAWI-S) as a product of 3 studies and the dimensions in their previous study have been replaced with a single dimension of perceived aesthetics. As a result, concluded that the short version contributed to a superior approximation than long version of the VisAWI. In the studies, the inventory has been replaced by 4 items inventory by reducing the less representative items with their dimensions and consistency and reliability of new inventory is tested with participants. The new inventory presented is claimed to work in any interfaces including mobile device screens and captures a single dimension of perceived aesthetics of web sites. Ngo et

al. (2003) indicated that the participants have also considered screens that are considered as aesthetic regarding to the formulae, as aesthetic. As previously mentioned, aesthetic appeal of a user interface is not solely sufficient enough to facilitate an educational mobile or web interface. Zain et al. (2008) gives importance to aesthetics due to its potential power on usability, acceptability, learnability, comprehensibility and productivity. The authors describe the accuracy of Aesthetic Measurement Application by measuring aesthetic of a learning user interface and comparing the results with the users' perceptions. The results show that data gathered from application and the participants' perceptions of aesthetics are consistent and as expected. However, AMA might be insufficient to describe aesthetic dimensions; hence limitations on the study oblige the AMA to be facilitated.

Vogel (2013) researched the aesthetics of web sites as a dimension of the user experience and discussed that the assessment of aesthetics cannot be static because it is found that the aesthetic judgments of the users is affected and changed throughout the user experience cycle.

2.7   Summary of Literature Review

Since the educational user interfaces have become very popular, a great number of research in the area has been conducted in order to understand how it affects students, learning, and how to enhance these tools so that their functionalities can actually improve. Majority of the studies in the literature usually focuses on the usability of user interfaces however, the studies focusing on the aesthetics of the user interfaces used for education are very few and limited. Nevertheless, there are researchers focusing on the effects of aesthetics of the user interfaces on learning, motivation, failure, students, user interface preference, and cognitive system.

Although it is not possible to generalize the findings of studies to the entire population of learners, the majority of the studies suggest that aesthetics plays an

important role on learning by either evoking positive emotions, enhancing cognitive engagement on task, increasing learner motivation, or reducing cognitive load. On the contrary, a very few number of studies mentions that the aesthetic elements integrated in the interface can distract the attention and increase cognitive load.

The term aesthetics is considered as a subjective concept at first, yet various studies suggests frameworks, instruments, guidelines, software, or mathematical equations for measuring the perceived aesthetics of the user interfaces. Majority of the studies analyzed the general visual design principles and the came up with the most common understanding of aesthetics by categorizing it. Simplicity, color, balance, density, complexity, shapes of the objects, and gestalt principles are just very few of the mentioned dimensions of aesthetics discussed in the literature. No matter how many aesthetic dimensions are categorized, almost all of the aesthetic measurement instruments score similar dimensions. These dimensions are either scored by the users or calculated by a software for measuring the perceived aesthetics, yet majority of the instruments are not consistent, and reliable due to the repetitions, and varying articulation of the aesthetic measurement items at each times. Also, most of the instruments ask very general and controversial questions in the sense of aesthetics. One of the instruments were developed due to lack of a consistent, reliable and objective aesthetic measurement instrument, which integrated the simplicity, diversity, colorfulness and craftsmanship of the user interface into the sub-dimensions of the overall aesthetics of a user interface.

Web and mobile user interfaces are treated equally in terms of aesthetics. However, whether they can be treated equally is unproven.

CHAPTER 3

METHODOLOGY

The third chapter covers the research methodology in detail gathering mainly six categories for explaining the overall design of the study and justification of the adopted research method, research questions that bring light throughout the study, context of the study including the LMS used to measure perception of aesthetics and procedures of the study, participants who provided both quantitative and qualitative data, two data collection instruments: Visual Aesthetics of Websites Inventory (VisAWI), and the interview guide, analysis of qualitative and quantitative data, and finally, assumptions and limitations of the study.

3.1   Research Questions

This study was conducted searching for answers to the following research questions:

Research Question 1: Is there a difference between students' perceived aesthetics of web and mobile interfaces of the LMS with regard to the Visual Aesthetics of Websites Inventory (VisAWI).

Sub-Questions:

R.Q.1.1. Is there a significant difference in perceived simplicity dimension scores of web and mobile interfaces?

R.Q.1.2. Is there a significant difference in perceived diversity dimension scores of web and mobile interfaces?

R.Q.1.3. Is there a significant difference in perceived colorfulness dimension scores of web and mobile interfaces?

R.Q.1.4. Is there a significant difference in perceived craftsmanship dimension scores of web and mobile interfaces?

Research Question 2: What are the overall perceived aesthetics of web and mobile versions of the LMS?

Research Question 3: What are the students' opinions about the effects of visual aesthetics of the LMS on learning?

3.2   Overall Design of the Study and Justification of the Method

In this study, we compared the web and mobile interfaces of learning management system (LMS) used in Middle East Technical University in terms of students' aesthetic perception. Due to the immediate acceptance and presence of mobile user interfaces in educational contexts, further research on these tools is obligatory. Unless one knows the effects of a rambling, unwisely designed mobile educational material on learners for sure, it would be heading for a fall in education. Exposing learners to a weakly designed mobile educational user interface for a period of time might lead to undesired consequences. The nature of mobile devices has led us to research on the differences between user interface designs of web and mobile in terms of visual appeal. Consequently, the primary intent of this study is to acquire a better understanding on the learner behaviors towards web and mobile user interfaces in terms of aesthetics of the interface design.

As the research methodology, embedded experimental design was used to determine the perceptional differences between aesthetics of web and mobile versions of ODTUClass learning management system. Due to the need for a treatment on the learning management system course pages, before the analysis the most frequently used tasks were determined, and the course pages are designed accordingly. After the

students performed tasks on the interface, the VisAWI was distributed to evaluate both web and mobile versions of the LMS. In order to further explain and support the findings of quantitative data, the qualitative data was collected via the interview guide.

Convenience sampling methods were preferred throughout this research. In order to eliminate the effect of differences between the previous experiences with the interface, we have selected all the participants from Middle East Technical University, so that the participants had almost equal experience with the ODTUClass learning management system. Volunteer participants from the department of Computer Education and Instructional Technology (CEIT) in Middle East Technical University were selected as participants who are from all 4 years of university educations from freshman year to senior. Another quality of sampling the participants from CEIT department is that all the participants have similar technical skills.

3.3   Context of the Study

3.3.1   Information about the Courses

After reviewing the literature on the aesthetics and visual designs that were mentioned in the previous chapters, the VisAWI aesthetic appeal measurement were performed as a pilot study with the participation of 17 volunteer students different from the ones participated in the actual study, yet the data collected from 2 of the participants were eliminated due to the missing values. The pilot study was conducted in order to test the instrument and understandability of the questions, and to explore the interview questions that are collected for supporting the quantitative findings. The pilot study showed that Turkish students were having difficulties in understanding the English versions of some terms related with aesthetic dimensions. It was clearly stated in the VisAWI manual that it was appropriate to translate the inventory in different languages. Based on the pilot study results and VisAWI

manual, the inventory was translated into Turkish for the Turkish students, and kept in English for the foreign students so that they could understand the questions better.

Four different courses from each academic year that were offered by the department of Computer Education and Instructional Technology in the 2015-2016 Spring Semester at a public university named Middle East Technical University was selected for the actual study. The courses were selected randomly as the type of courses did not matter for the analysis of this research. Each course was visited before the data collection and the course pages were organized in a way that all the students in all the courses could be dealing with the same tasks before evaluating the aesthetics of interfaces. The course codes where the number of students from each course participated in the study are presented in Table 3.1.

Table 3.1: Course codes, names and the number of participants

Course Name	# of students
CEIT 112-Information Technology in Education II	37
CEIT 211- Programming Languages II	34
CEIT 213- Computer Hardware (pilot)	17
CEIT 390- Database Management Systems	27
CEIT 520- Research Methods in Computer Education	15

In the lab sessions of all the sections of these four courses, two Visual Aesthetics of Websites Inventory abbreviated as VisAWI were distributed to the students. Students were expected to complete the two different 7-point Likert scale, 18 question inventories after implementing some tasks specific to the course on both web and mobile screens.

3.3.2 The Learning Management System

Learning management systems are also known as Course Management Systems (McIntosh, 2016). LMSs are very popular among various the institutions, schools, universities, and online learning sector. With a potential of presenting content, managing learning activities and many other facilities, LMSs are preferred by massive numbers of learners from all around the world, and from all ages. There are various LMSs that are personalized specific to the institutions. McIntosh (2016) explains the dynamic structure of learning management systems as follows:

> To add to the confusion, many educational institutions and corporations brand their systems differently within their organizations. For example, the University of Akron calls its implementation of Desire2Learn "Springboard!" This can make it difficult to find out if an organization is using a commercial LMS or one they built for themselves. (p. 5)

As mentioned above, there are countless of LMSs out there, and the LMS that is used in this study is an open source LMS-called Moodle based learning environment. The aesthetic appearance of Moodle can be designed unique to the organization. ODTUClass (see Figure 3.2; Figure 3.3; Figure 3.4) is also a re-touched version of Moodle system that is aesthetically designed specific to the university. In this study ODTUClass was aesthetically evaluated in terms of aesthetic dimensions presented in VisAWI, which are "simplicity, diversity, colorfulness and craftsmanship."
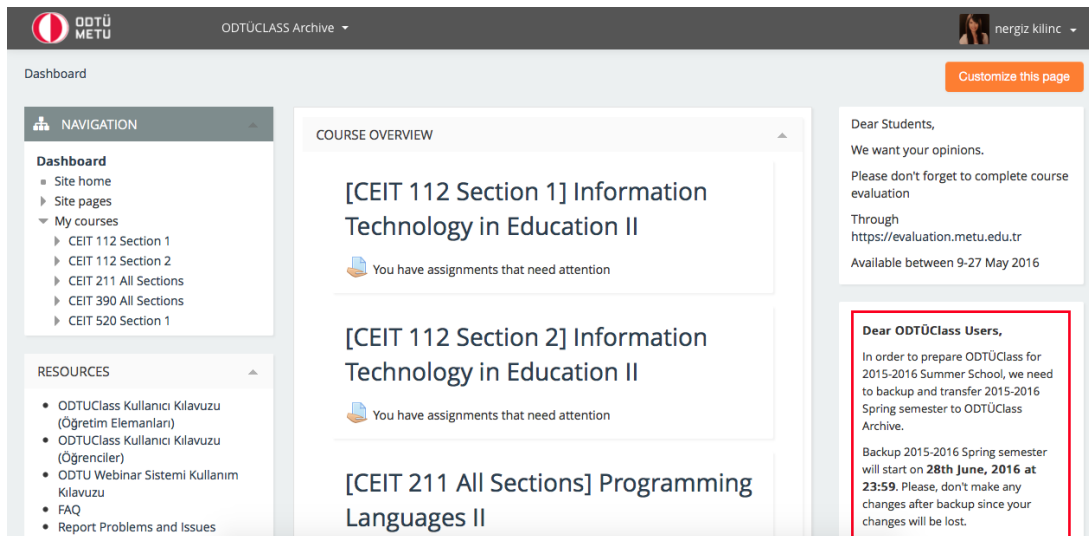
Figure 3.1: Web interface of the dashboard section of ODTUClass- Student view
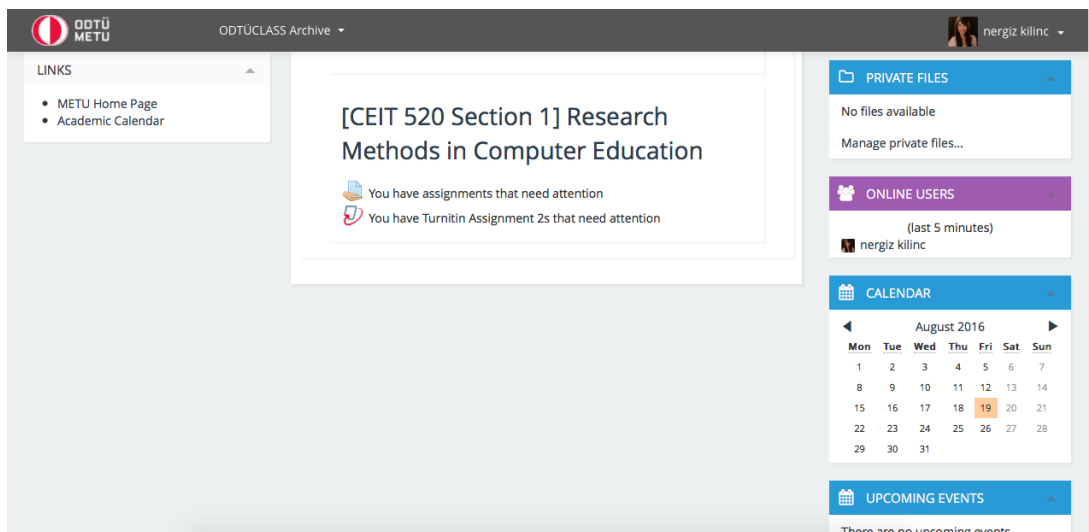
Figure 3.2: Web interface of the dashboard section of ODTUClass- Student view
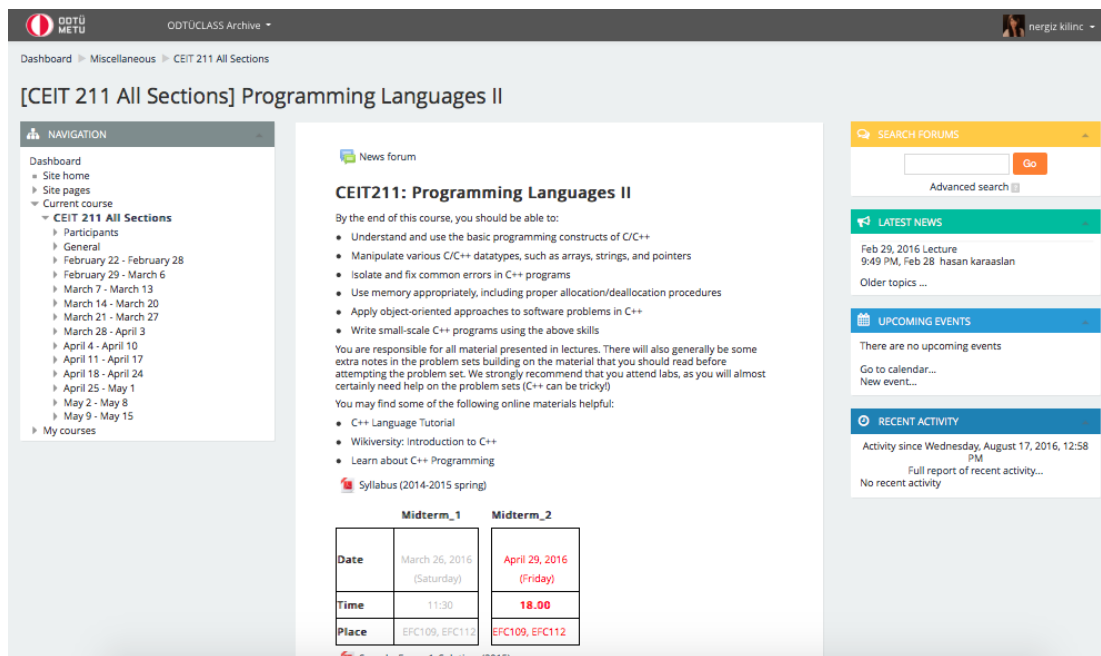
Figure 3.3: Web interface of the current course section - Student view

ODTUClass was used in this study because ODTUClass is a learning management system that is officially approved as specific to Middle East Technical University, which means that in almost every course, this LMS is being used. Therefore, all the participants could have the access to the system as well as the resources, and prior interaction experiences of students with the ODTUClass were relatively equal. Secondly, the purpose of the study was to measure the aesthetical differences between web and mobile screens, and the study will not be able illustrate valid and reliable results if the familiarity of the students with the user interface would vary. Thirdly, ODTUClass was designed with a responsive web design which will provide the study the opportunity to measure aesthetic perception differences between exactly the same content and almost the same number of elements visual design elements including colors but only was fit in a smaller screen size of the mobile version (see Figure 3.5; Figure 3.6; Figure 3.7). It was a very appropriate LMS for this study as it was certain that the mobile learning functionality was integrated. As McIntosh (2016) stated:

Many vendors are beginning to add mobile learning functionality to their LMSs so learning can be accessed on smartphones and other small mobile devices. Many offer "responsive" output that automatically adjusts to the size of the viewing screen. Many mobile features are available as "apps" for which there are many suppliers. (p. 4)

As mentioned above, some of the user interfaces are designed such that an entirely different visual design is generated for the mobile version of the website.

There might be some advantages of m-dot designs over the adaptive and responsive designs: ability of creating rapidly and economically; and being more functional than a web site on a mobile device screen (Cyr, 2015). Nevertheless, ODTUClass uses a responsive design which is simply the exactly the same website design for a web screen integrated in a mobile device screen.
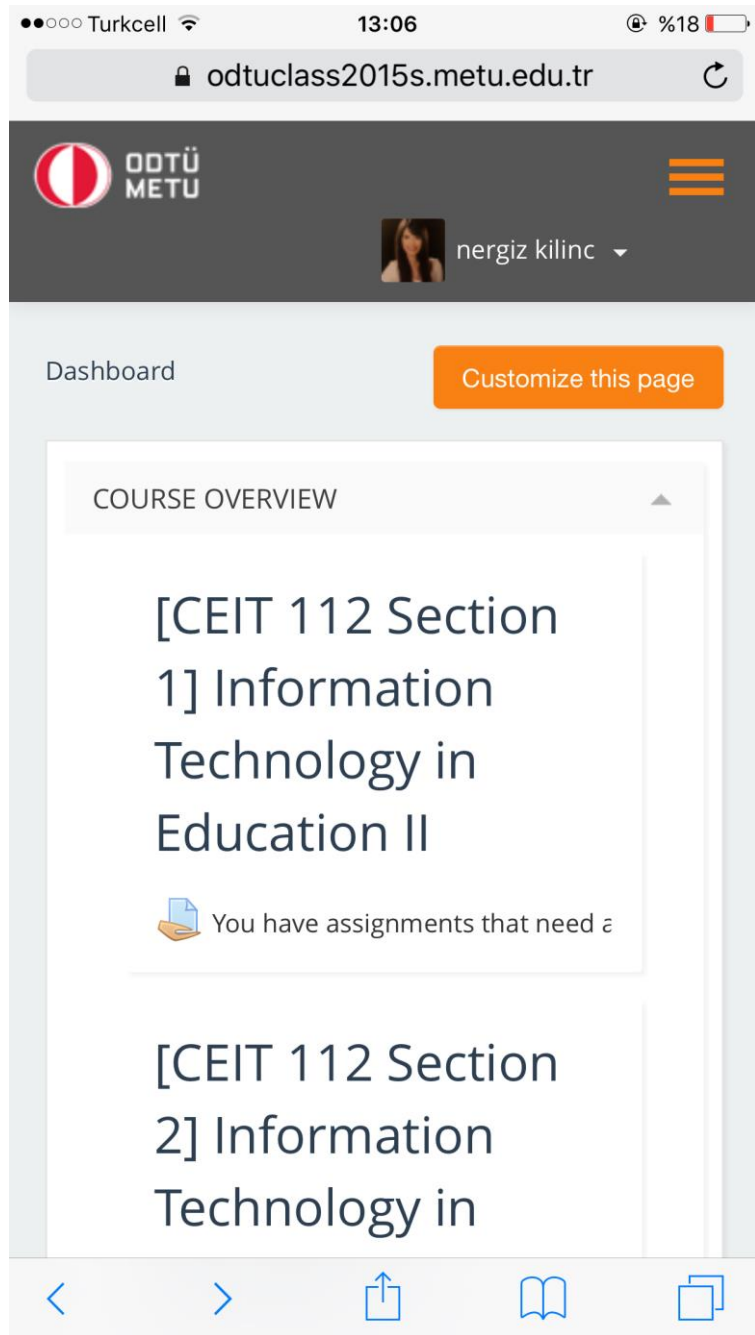
Figure 3.4: Mobile interface of the dashboard section- Student view
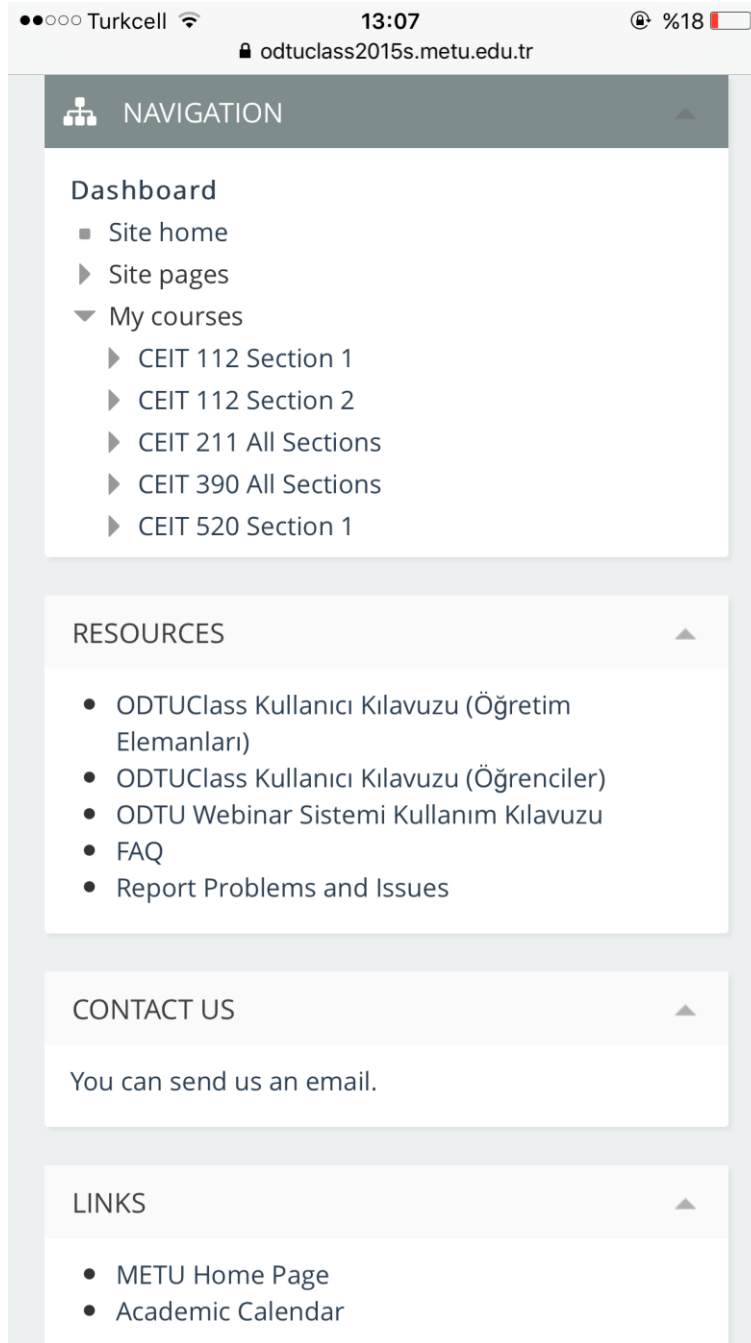
Figure 3.5: Mobile interface of the dashboard section- Student view
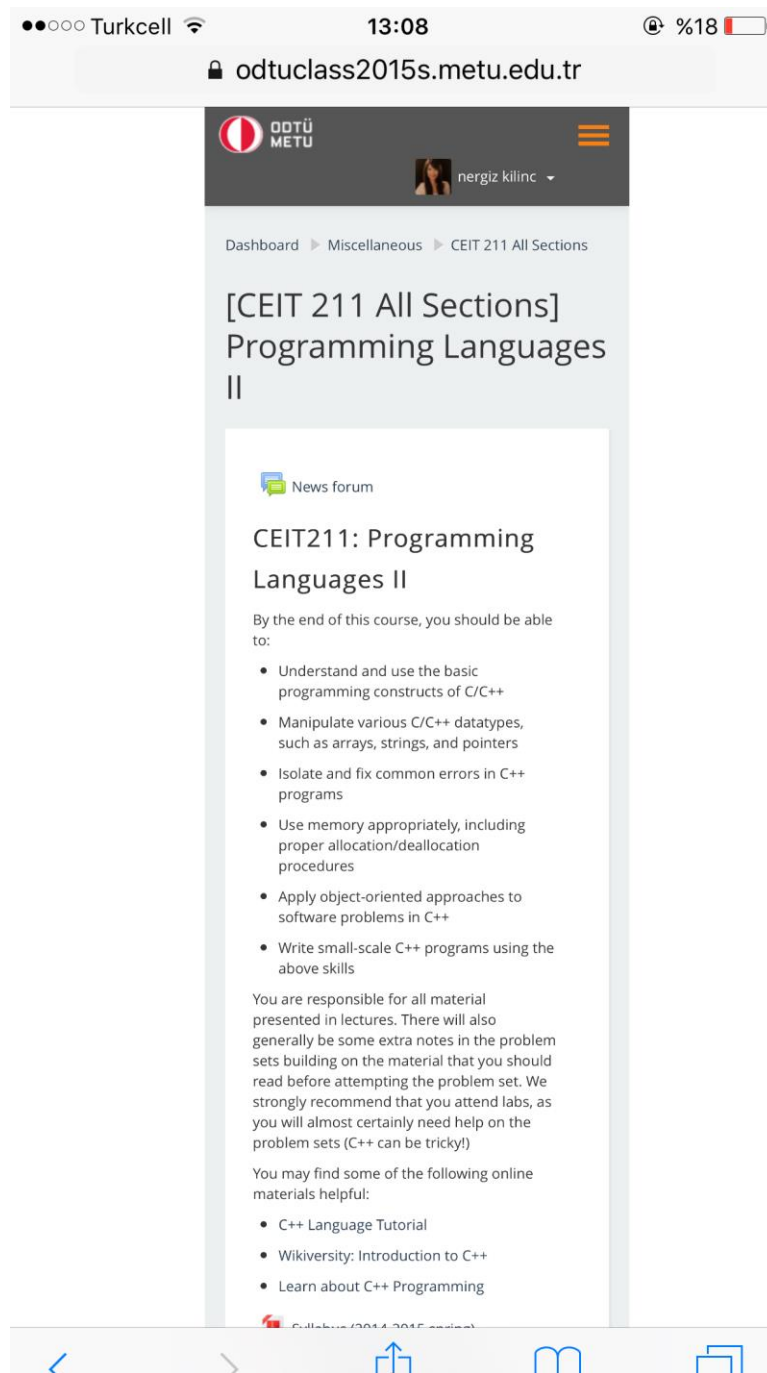
Figure 3.6: Mobile interface of the current course section- Student view

read before attempting the problem set. We strongly recommend that you attend labs, as you will almost certainly need help on the problem sets (C++ can be tricky!)

You may find some of the following online materials helpful:

- C++ Language Tutorial
- Wikiversity: Introduction to C++
- Learn about C++ Programming

📄 Syllabus (2014-2015 spring)

	Midterm_1	Midterm_2
Date	March 26, 2016 (Saturday)	April 29, 2016 (Friday)
Time	11:30	18.00
Place	EFC109, EFC112	EFC109, EFC112

📄 Sample_Exam_1_Solutions(2015)

📄 Sample_Exam_2_Solutions (2015)

The following resource may be useful to understand the classes:

From the Safari Books Online (Under the link lib.metu.edu.tr>databases>Safari Books Online)

the book: **Object-Oriented Programming with C++, 1/e, By: A.K. Sharma**

But the link may not be reachable outside METU.

📄 Midterm I (Results)

📄 Midterm2_Results

📄 Final_Exam

    Results

GRADES:

Your Total calculated as:

Total=%5 in class Quiz + %25 LAB +%5 Lab Quiz + %20 M1 + %20 M2 + 30 F

BRQ: Basics Review Quiz , Q1-Q4: In class quiz

QT=Average(Sum (BRQ and Q1 to Q4))

LT=Average (Sum of L1 to L9) , LQT=Average (Sum of LQ1 to LQ3)

📄 GRADES

Figure 3.7: Mobile interface of the current course section- Student view
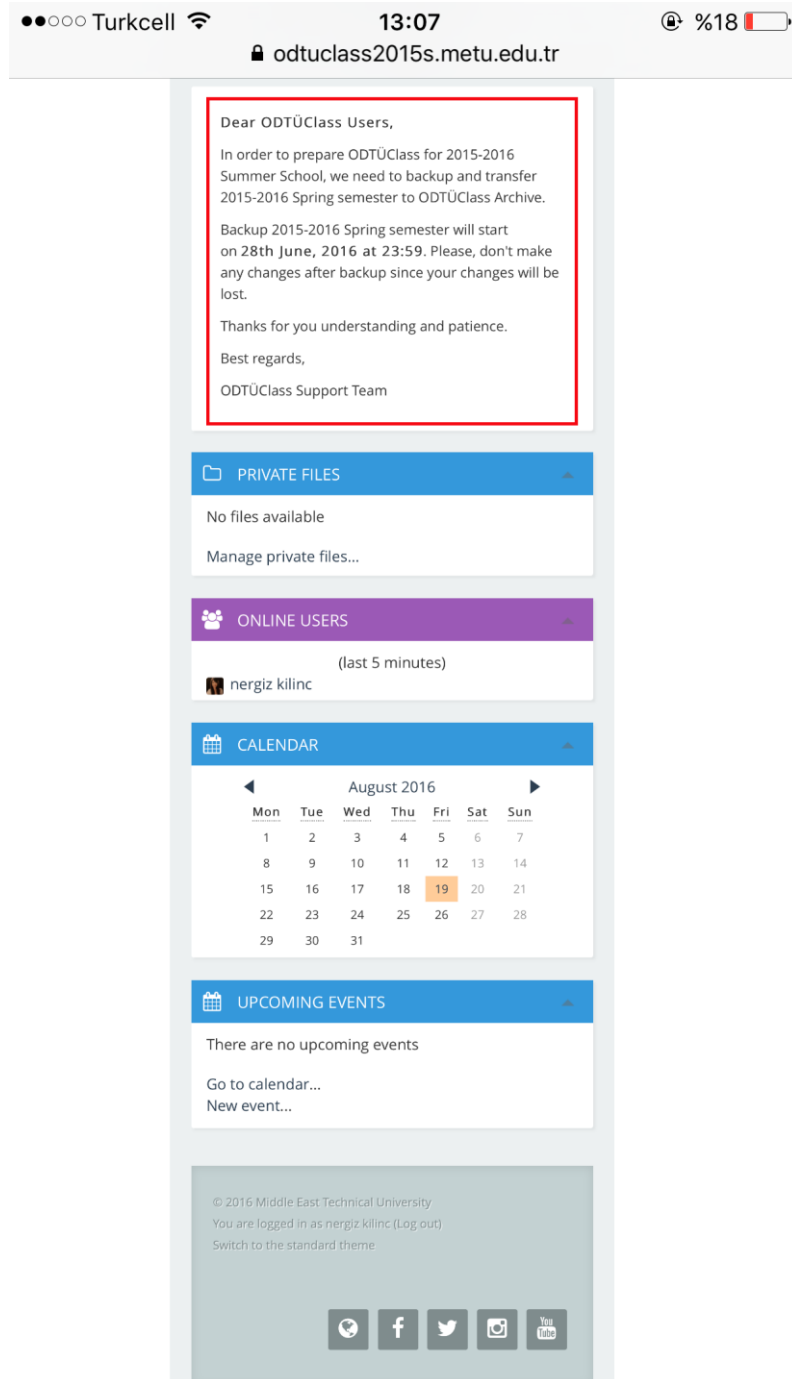
Figure 3.8: Mobile interface of the current course section- Student view

3.3.3 Procedures of the Study

In order to find answers to our research questions, literature on visual design, usability, and online learning have been reviewed. Various approaches in the literature towards the aesthetic or visual measures as well as usability measures were analyzed. As the existing literature coincides with the idea suggesting that user interface design for mobile device screens should be treated differently, a sufficient number of mobile domain specific usability measures were gathered, yet very few aesthetic measures for mobile user interface design was gathered. Because mobile learning is a new concept, there is not enough foundation to define the factors affecting mobile aesthetics in the literature. A study that is conducted to examine the usability interface design for a wireless mobile device suggested that the majority of the design principles of user interface could be transferred to mobile devices. Aesthetics have been considered "as a part of overall enjoyable user interface experience with mobile devices." (Cyr et al., 2006).

An extensive research was made on the aesthetic measurement and was attained a number of different aesthetic measurement instruments through the literature review. Following the literature review, the frequently used sections of LMS were determined through a previous investigation. The students were asked which major parts they use for each courses and the most frequently used features of ODTUClass were determined as uploading homework, downloading resources, posting to a forum, creating a discussion, checking calendar, upcoming events, navigating to the previous semesters using "Archive". After the frequently used features were determined, a number of tasks (see: APPENDIX B) were generated so that the students would be able to be familiar with the interface before evaluating its aesthetics. These tasks were kept constant for all the courses. Then, a course was randomly selected for a pilot study to test the instrument and procedures. The selected course was designed according to the pre-determined tasks that are combined of the most frequently visited sections of ODTUClass.

After the selection of participants, the students were distributed the tasks to complete before evaluating the interfaces of the LMS. The tasks used for web and mobile interfaces were exactly the same as the content was exactly the same. After the completion of tasks, the students were distributed a pair of VisAWI: one for web and one for mobile interface of the LMS. Throughout the data collection, the students used the desktop computers in the computer laboratories in the department, and the sizes of mobile devices were approximately the same.

The quantitative data was collected via Visual Aesthetics of Websites Inventory (VisAWI): a 7-point Likert scale aesthetic measurement instrument. Following the quantitative data collection, supporting qualitative data was collected through an interview guide, which mainly focused on the opinions of students about the overall aesthetics of both interfaces and the effect of perceived aesthetic of an educational medium (LMS) on learning.

The quantitative data collected via VisAWI was analyzed according to the method described in the VisAWI manual in order to calculate the overall aesthetics and the value of each aesthetic dimension, separately. Following the aesthetic measurement of web and mobile interfaces, a paired samples t test was used to compare the mean values of each aesthetic dimension.

After collecting and analyzing the quantitative data, an interview that was prepared based on the analysis of quantitative data collected previously, was made with the participants for collecting qualitative data necessary for the interpretation of the research results.

3.4 Participants of the Study

Granić and Ćukušić (2011) revealed that IT skills affect the performance while assessing design usability and aesthetics in an e- learning system. Therefore, participants of the study will be selected from the students studying in METU having a certain level of competence in computer literacy. Therefore, our study will be

tested and data is going to be collected from CEIT students in METU. Convenience sampling seems to be the most appropriate sampling for our research design.

A total of 130 volunteer students varying from freshmen to senior in CEIT department at Middle East Technical University were participated in this research. 17 of these students different from the actual study have voluntarily involved the pilot study at the beginning of the research in order to pre-test the tasks, instruments and the research protocol, however the data gathered from 2 participants had missing values therefore, was eliminated. The data gathered from 15 students were used in the pilot study. Remaining 113 students have provided their contributions in the actual study. Because there weren't any missing or problematic data, there was no need for data elimination in the actual study. All the students were taking at least one of the courses mentioned. There were multiple sections for the CEIT 112, CEIT 211, CEIT 390, and CEIT 520 courses, and in each section of courses, VisAWI was performed with the students who have attended the lab that week. The participants that were absent that week had an opportunity to participate in the research in the following weeks. Each student has participated in the quantitative data collection part of the study once, but the students who took place in the quantitative data collection have made a contribution for the qualitative data collection for only once. In order to arrange meetings with the students, the instructors have given permission to allocate some time from the last or first 10 minutes of the lab session for quantitative data collection procedure. Out of 128 participants, only 10 students accepted to spare time for the interviews, which took approximately 10-13 minutes per participant. The qualitative data was collected from different academic years in order to represent the entire population. However, due to the subjective nature of aesthetics, each individual provides unique data no matter how it can be measured objectively. Therefore, it was not possible to generalize the qualitative data to the entire population but the qualitative data shows some evidence and support on the accuracy of the quantitative data.

3.5 Data Collection Instruments

3.5.1 Visual Aesthetics of Websites Inventory (VisAWI)

There are countless numbers of studies that propose an aesthetic measurement instrument. Moshagen and Thielsch (2010) lists various studies on the subject matter, yet all of them uses self-report measures such as "single-item measures, ad-hoc developed scales, single scales that are taken from more general instruments" for the aesthetic evaluation of user interface designs (Kawabata & Zeki, 2004; Ngo et al., 2003; Papachtistos et al.,2006; and Schenkman & Jönsson, 2000). The problem with the single item measure that is popular for measuring aesthetics is that they are not very reliable because of the error factor in the scale. (Schmidt & Hunter, 1996). Another problem of the single-item measure is the bias that cannot be eliminated by combining both negatively and positively keyed items (Motl & DiStefano, 2002). On the other hand, while measuring the aesthetics of interfaces, the articulation of the actual item almost never used the same. Multiple-item measures are also open to criticism because the items used for measuring visual appeal are synonyms such as "visually pleasing" and "visually appealing", hence they are used repeatedly in the measure (Moshagen &Thielsch, 2010). The existing aesthetic measures are non-reliable, biased and are unable to give valid outcomes.

In this study, instrument for measuring the visual aesthetic pleasure named- VisAWI designed by Moshagen and Thielsch (2010) was preferred due to the lack of a reliable valid instrument in order to measure the visual aesthetics of ODTUClass user interfaces. Although the instrument was not sufficient enough to measure some other perspectives of aesthetics such as sounds, it was a very easy and practical instrument for collecting large numbers of data, as the redundant items that are repeatedly used in other inventories were eliminated and VisAWI was suggested after a number of experiment and iterative elimination process. VisAWI, is a simple 7 point Likert scale questionnaire that is combined from four main dimensions of visual aesthetics that are: simplicity" of the interface, "diversity" of the user interface elements,

"colorfulness" of the overall interface, and finally the professionalism of the design mentioned as "craftsmanship" (see: Figure 3.9). Under each dimension, the researchers came up with systematic questions in order to measure each aesthetic dimension separately, and by combining the entire results, measuring the overall perceived visual aesthetics of the user interfaces. Thielsch and Mochagen (2015) explain the purpose of each single dimension as follows:

> The items measuring Simplicity ask how clearly and structured the layout of a web- sites is perceived. The scale Diversity asks to evaluate the inventiveness and dynamic of the layout. Colorfulness comprises aspects of color composition, choice and combination. The fourth scale Craftsmanship refers to the topicality, sophistication and the professionalism of the design. (p. 6)
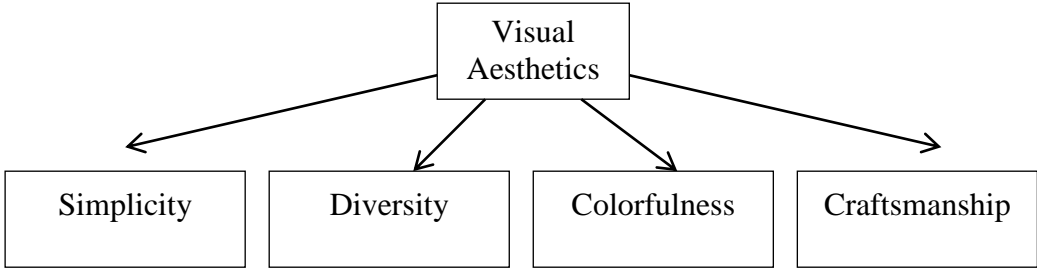
Figure 3.9: Structural model of VisAWI

VisAWI needs to be used with the participation of at least 20 users for gathering quantitative data. When the number of participants is below 20, qualitative data can be collected through VisAWI. Participants can either presented in online or paper-pencil form. It is reported that the completion of the entire questionnaire takes approximately two to three minutes, yet it took approximately 6 to 8 minutes per participant in this study as the same inventory were distributed not only for measuring aesthetics of web but also the mobile user interface design. The questionnaire was distributed in a paper- pencil format.

3.5.2 Interview

After the analysis of all the qualitative data were collected and analyzed, interview was made with 10 of the participants previously attended to the quantitative data collection process. Hence, the advisor professor and the researcher prepared 14 interview questions, which have gone under several updates before conducting the interviews based on the feedback of the advisor professor. An expert reviewed the questions for the most convenient articulation. The interview has been made in English, in order to articulate the most appropriate terms that might not be expressed correctly in another language, and mainly to develop an understanding about the significant difference between the aesthetics of web and mobile LMS user interface design, and to learn their opinions about the importance and effect of perceived aesthetics of an educational user-interface design on their learning. The interview guide is presented on the appendix part of this research study. The interviews have started with a short, introductory speech in order to inform the participant about the purpose of the interview, the number of questions that I will be asking, and the approximate duration of the interview. After the introductory stage I have started asking the questions that were previously prepared. However, based on the course of the interview I have asked some leading questions in order not to digress from the research questions. The interview then ended with the additional suggestions or contributions of the participants on the topic whenever they wished to share their suggestions. Final part of the interview was ended with the interviewer's special thanks to the participants for their precious contributions on the study.

3.6 Data Analysis

Both qualitative and quantitative data analysis methods will be used in this embedded experimental research. The data collected via VisAWI was analyzed with a paired samples t test and the aesthetic scores were calculated by finding the mean values of each dimension. The data obtained from interviews will be analyzed with

Qualitative Data Analysis Methods, while the data gathered from VisAWI will be analyzed with Quantitative Data Analysis Methods.

3.6.1 Analysis of the Quantitative Data Collected from VisAWI Inventory

The data collected from VisAWI, was started with the recoding of negatively keyed items of the questionnaire by subtracting the actual scores gathered from participants from 8. Because there are a few negatively expressed items in the inventory, the recoding will help the high scores represent high values on the scale (see: Table 3.10). As seen in the Table 3.2, the negatively-keyed items are marked with the sign (r) and their Likert values are subtracted from 8 so that, if the actual score of the item is 1, the recoded score of the item will be 8-1=7. Similarly, the Likert score 2 will be recoded as 6, 3 as 5, 4 as 4, 5 as 3, 6 as 2 and 7 as 1 (Thielsch & Moshagen, 2015). Following the recoding scores of the negatively-keyed items, the likert value of each sub scale will be added and divided by the number of the items under the respective sub-scale in order to find the value of each sub-scale. The items are represented as questions under each visual aesthetic dimension. For example, the Simplicity sub scale has 5 questions meaning 5 items, therefore the divisor of the simplicity subscale score was determined as 5. Finally, the overall mean of the questionnaire was found by adding the cores of all sub-scale values and by dividing the result by the number of sub scales, which is 4: simplicity, diversity, colorfulness and craftsmanship.

Table 3.10: Items of the VisAWI

#	Item	Aesthetic dimension
1	**(r)* The layout appears too dense.**	Simplicity
2	The layout is easy to grasp	
3	The layout appears well structured.	
4	**(r) The site appears patchy.**	
5	Everything goes together on this site.	
6	**(r) The design is uninteresting.**	Diversity
7	The layout is inventive.	
8	**(r) The design appears uninspired.**	
9	The layout appears dynamic.	
10	The layout is pleasantly varied.	
11	The color composition is attractive.	Colorfulness
12	**(r) The colors do not match.**	
13	**(r) The choice of colors is botched.**	
14	The colors are appealing.	
15	The layout appears professionally designed.	Craftsmanship
16	**(r) The layout is not up-to-date**	
17	The site is designed with care	
18	**(r) The design of the site lacks a concept.**	

(r)*: Negatively-keyed item that was recorded for the analysis.

After the analysis of perceived aesthetics of user interfaces, a paired samples t- test between the sub-scales of both web and mobile user interfaces were done. IBM SPSS was used in order to analyze the differences between the web and mobile user interfaces of ODTUClass in terms of perceived aesthetics of participants. Each sub scale score of the web version of LMS is compared with its pair representing the mobile user interface aesthetics.

Additionally, basic descriptive statistics about the participants and the data were also analyzed including number, mean, median, mode, standard deviation.

3.6.2 Analysis of the Interviews

The qualitative data was collected via the interview guide. (see: APPENDIX A). An audio recording device recorded the interviews throughout the interview. The recordings of each individual participant were then transcribed, converted into text, and deductive qualitative content analysis was performed by categorizing the commonly mentioned ideas and themes that might serve as an answer to the research questions guiding this mixed- methods research study. The supportive ideas that were caught in the qualitative data were reported to strengthen the reliability of the quantitative study and use for explaining the quantitative research outcomes. Themes and the codes were determined through content analysis were presented in the APPEDIX E.

3.6.3 Role of the Researcher

The researcher is an M.S. student in METU, CEIT department, who uses ODTUClass frequently in other courses. Role of the researcher in this study was to arrange the appropriate settings for investigating the research questions by collecting both quantitative and qualitative data. Before collecting the data, the researcher investigated the most frequently used features of the learning management system, and designed each course page accordingly so that the tasks that the participants needed to perform before evaluating aesthetics could be the same for all the participants. Another important role of the researcher was to analyze both quantitative and qualitative data. Although the instrument used for visual aesthetics of interfaces was valid, previously prepared commonly used VisAWI, making slight changes on the questionnaire were allowed by the researchers who were created the instrument. Because of the apprehension of possible struggles of students on the language, the instrument designed as English were initially translated into (see: APPENDIX D) and distributed in the Turkish version to the student who asked, and English version was used as it was for the foreign participants. Following the

analysis of the first study, together with the advisor professor, the researcher has developed interview guide for follow up qualitative data on the subject manner.

3.6.4 Assumptions

The following statements were assumed in the study:

- All the students finished VisAWI by reading each question carefully.
- The answers of the participants to VisAWI were not randomly marked.
- All the participants contributed to the qualitative study with honesty and their true ideas.
- The VisAWI instrument used for quantitative part of the research is reliable, valid and verified.
- The interview guide and the questions were qualified.

3.6.5 Limitations

The inventory that is used for gathering quantitative data is one of the most reliable instruments developed on the measurement of aesthetics in user interfaces, yet it is not able to measure some other dimensions that might be considered as an aesthetic dimension such as sounds.

Validity of this study is limited to the results gathered from 128 CEIT students studying in METU. The measured website ODTUClass or the participants took place in the study cannot be considered as the representatives of the general population of people interacting with a user interface. Another limitation of this study is that the participants contributed to the study are the members of a certain culture.

Although the reliability and clear structure of the inventory provides ease of data collection, whenever data is collected for multiple user interfaces as happened in this study, the data collection process and its analysis was time-consuming. Additionally, the participants were presented tasks aiming to foster participants visualize every part of LMS by navigating them into different sections of ODTUClass.

After completing the tasks, students had to finish VisAWI for both web and mobile, which protract the data collection process more than suggested. Moshagen and Thielsch (2010, p. 23) says: "Although completing the VisAWI takes less than 3 min, the VisAWI may still be so lengthy in some research settings, for example when needing a simple manipulation check."

CHAPTER 4

RESULTS

The fourth chapter will discuss the data obtained for this study under two main titles: Firstly, the quantitative data analyses will be explained providing the research results in tables. As for the quantitative data, the purpose was to find sufficient answers for the first and second research questions. On the other hand, the Qualitative data collected from 10 participants are categorized and the analyzed hoping that they serve an answer for the third and fourth research questions.

4.1   Quantitative Data Analysis Results

The statistical results for the perceived visual aesthetic dimensions of VisAWI: "Simplicity", "Diversity", "Colorfulness", and "Craftsmanship" are presented in this section. The purpose of the quantitative data was to explore answers for the first research question that were mentioned in the previous chapters. In the subsequent sections the respective research questions will be discussed and the corresponding test result for each research question will be interpreted.

4.1.1   The Statistical Results for the Research Question 1 and 2

This study concerned with a total of 3 research questions. As aforementioned, the first two research questions were expected to be explained with the help of the quantitative data that were collected with the participation of 17 CEIT students for the pilot study. However, the data collected from 2 participants were eliminated due to missing values. Therefore, 15 data out of 17 were analyzed for the pilot study, and 113 CEIT students for the actual study.

The first two research questions were as follows:

Research Question 1: Is there a difference between students' perceived aesthetics of web and mobile interfaces of the LMS with regard to the Visual Aesthetics of Websites Inventory (VisAWI).

Sub-Questions:

R.Q.1.1. Is there a significant difference in perceived simplicity dimension scores of web and mobile interfaces?

R.Q.1.2. Is there a significant difference in perceived diversity dimension scores of web and mobile interfaces?

R.Q.1.3. Is there a significant difference in perceived colorfulness dimension scores of web and mobile interfaces?

R.Q.1.4. Is there a significant difference in perceived craftsmanship dimension scores of web and mobile interfaces?

Research Question 2: What are the overall perceived aesthetics of web and mobile versions of the LMS?

In order to investigate the first research question, a total of 113 students were distributed a pair of task papers: one for web and one for mobile interface in order to make sure that all the participants were exposed to the same sections of the user interface before evaluating their aesthetics. After the students completed the tasks, a pair of VisAWI inventory was distributed in their lab sessions: one of them was for assessing the visual aesthetics of ODTUClass user interface designed for web screens, while the other one was for measuring aesthetics of the LMS designed for mobile screens.

The histograms for the data were checked in order to conduct a normal distribution test and data collected found to be normally distributed. In order to compare two user

interfaces of the LMS, a paired samples t-test was conducted on SPSS. As the results of t-test illustrates (see: Table 4.1), the average scores for each aesthetic factor seems to be relatively high. Mean value for the Simplicity dimension for the web screen was reported as 4.89-above the average hence it can be said that the participants have perceived the interface of ODTUClass designed for the web screen clear and structured. Similarly, the participants scored the "Simplicity" mobile user interface as 4.52 which is very slightly lower than that of web version, yet 1 score above the average. Additionally, the standard deviation of the simplicity dimension is 1.12 while the other aesthetic dimensions have similar standard deviation scores. Moreover, mean score for the aesthetic dimension "Simplicity_web" has the highest value among all the other dimensions, while the "Diversity_mobile" dimension has the lowest score amongst all the other aesthetic dimensions. The relatively lower score for the diversity_mobile item can be interpreted as the participants have found the mobile version of ODTUClass layout averagely inventive and dynamic. The overall figure demonstrates that all the aesthetic dimensions have very similar scores for both the web and mobile versions of the user interface.

Lastly, looking at the overall picture, it is clear that all the mean scores of web versions are higher than the mobile versions. In order to be able to understand the significance of these mean differences, Table 4.3 was presented.

Table 4.1: Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Simplicity_web	4.89	113	1.12	.11
	Simplicity_mobile	4.52	113	1.27	.12
Pair 2	Diversity_web	4.11	113	1.04	.10
	Diversity_mobile	3.83	113	1.12	.11
Pair 3	Colorfulness_web	4.50	113	1.21	.11
	Colorfulness_mobile	4.36	113	1.15	.11
Pair 4	Craftsmanship_web	4.64	113	1.07	.10
	Craftsmanship_mobile	4.31	113	1.25	.12

Before the interpretation of the significance of difference between web and mobile interfaces of aesthetic dimensions, paired samples correlation results will be evaluated. Table 4.2 illustrates the correlation results between the scores of web and mobile versions of each dimension. The correlation values .48 for pair 1, and .67 for pair 2, .65 for the pair 3, and .73 for the last pair which are statistically significant statistical results. These correlation values signify that the higher scores of the web version of aesthetic dimension are associated with the higher scores of the mobile version. In addition, high correlation scores imply that the standard error rate in testing the mean difference between pairs is low.

Table 4.2: Paired Samples Results

		N	Correlation	Sig.
Pair 1	Simplicity_web & Simplicity_mobile	113	.48	.00
Pair 2	Diversity_web & Diversity_mobile	113	.67	.00
Pair 3	Colorfulness_web & Colorfulness_mobile	113	.65	.00
Pair 4	Craftsmanship_web & Craftsmanship_mobile	113	.73	.00

In order to explain whether the mean difference of each pair is statistically significant, Table 4.3 will be evaluated. The results presented in the paired samples test table portrays that the mean difference between the web and mobile version scores of the simplicity dimension is .37 followed by the mean differences of .28; .14; and .33 for the diversity, colorfulness, and craftsmanship dimensions, respectively. The standard deviation for each pair is presented as 1.22; .88; .99; and .86 for each dimension pairs. The significance value for the simplicity_web and simplicity_mobile pair of dimension is .00, which is less than the p value .05 so that it would not be wrong to say that the perceived simplicity aspect of visual aesthetics for web is significantly different than the perceived simplicity aspect of visual aesthetics for the mobile user interface. The significance value for the diversity_web and diversity_mobile pair of dimension is .00 which is less than the p value .05 meaning that the perceived inventiveness and dynamics of visual aesthetics for web is significantly different than the perceived inventiveness and dynamics aspect of visual aesthetics for the mobile user interface.

Surprisingly, the p- value for the colorfulness_web and colorfulness_mobile pair of dimension is .14, which is higher than .05 meaning that the perceived colorfulness of visual aesthetics for web is not significantly different than the perceived colorfulness of visual aesthetics for the mobile user interface. This result might mean that the students cannot distinguish between the color composition, choice and combination of web and mobile versions of ODTUClass learning management system. The significance value for the last pair: craftsmanship_web and craftsmanship_mobile pair of aesthetic dimension is .00 which is less than the p value .05 meaning that the perceived topicality and sophistication and professionalism of the interface designed for web is significantly different than that of mobile user interface.

Additionally, the effect size of the analysis is small with Cohen's d value of .30 for simplicity dimension, and .32, .14, and .38 for the diversity, colorfulness and craftsmanship dimensions, respectively.

Table 4.3: Results of the Paired Samples Tests

		Mean	Std. Dev.	Cohen's d	t	df	Sig.
Pair 1	Simplicity_web – Simplicity_mobile	.37	1.2	.30	3.22	112	.00
Pair 2	Diversity_web – Diversity_mobile	.28	.88	.32	3.42	112	.00
Pair 3	Colorfulness_web - Colorfulness_mobile	.14	.99	.14	1.48	112	.14
Pair 4	Craftsmanship_web - Craftsmanship_mobile	.33	.86	.38	4.06	112	.00

Data collected from students participated in the VisAWI, was also evaluated in order to understand the participants' aesthetic judgments for the overall LMS. Values of each individual aesthetic dimension is added and divided by the number of dimensions, which is 4; in order to calculate the overall aesthetic judgment of the participants. The results point that the score for the web interface aesthetics was perceived above the average with the mean value of 4.54. Similarly, despite the perceptional differences, visual design of mobile version is found above the average with a slightly lower score of 4.27.

Table 4.4: Mean Values of Individual Aesthetic Dimensions

	Web	Mobile
Simplicity	4.89	4.52
Diversity	4.11	3.83
Colorfulness	4.50	4.36
Craftsmanship	4.64	4.31

The analysis revealed the mean values of each individual aesthetic dimension. Table 4.4 illustrates the results for both web and mobile versions of the user interfaces. Simplicity of the web was reported as 4.89 out of 7 while it is 4.52 for the mobile version of the user interface. Similarly, the mean values of diversity, colorfulness and craftsmanship of the web user interfaces are reported as 4.11; 4.50; and 4.64 respectively. The diversity of the mobile version is slightly below the mean value of diversity dimension of the web interface with a 3.83 mean value. Mean values of the last two dimensions of aesthetics: colorfulness and craftsmanship for the mobile user interface are 4.36 and 4.31 respectively. The figure shows that mean values of the all dimensions for mobile version are lower than that of web version of the interface. Moreover, overall mean value of web and mobile versions of the user interfaces are both perceived better than the average with a mean value of 4.54 for the web and 4.27 for the mobile version of the interface (see: Table 4.5).

Table 4.5: Overall Perceived Visual Aesthetics of the LMS

	N	Mean
Web	113	4.54
Mobile	113	4.27

4.2   Qualitative Data Analysis Results

The qualitative statistic results are presented in this section. A deductive content analysis has been performed on the collected data to further explore the previously analyzed quantitative data and to find answers for the third research question that was mentioned in the previous chapters. In the subsequent sections deductive content analysis results will be presented, the respective research question will be discussed and the corresponding analysis results for each research question will be presented.

Qualitative data collected with the help of interviews were conducted with the volunteer participation of 10 participants who have previously contributed to the quantitative research phase of this research. The interviews were recorded with an audio recording device, in order to easily transcribe the interviews for the analysis. Following the data collection, a categorization matrix was developed (see: Table 4.6). Considering literature, the codes that are related with the visual aesthetic design, its effect on learning, and motivation were determined. Later, interview data translated and coded to pick over the things that the students mentioned about the determined codes, themes, and concepts. After the coding is completed, the acquired data is reviewed and evaluated by comparing interviews as an iterative data analysis process. Perceptions of the students in terms of each dimension was collected, analyzed and categorized as positive and negative opinions and are presented in the following section.

4.2.1 Perceptions of Students in terms of Simplicity Dimension of Aesthetics

Table 4.6: Qualitative Analysis for Simplicity Dimension

Themes	Major Categories	Minor Categories	Person	
			Web	Mobile
Simplicity	Density	Appropriate	7	3
		Too Crowded/Too Dense	3	7
		Too Much Scrolling	1	9
	Finding the Content	Easy/Faster	9	1
		Difficult/Time Consuming	2	8

The categorization matrix for the simplicity dimension of the perceived visual aesthetics of the LMS is presented in Table 4.6. The interviewees were asked a number of questions in order to find out their perceptions on "how clearly and structured the layout" of the LMS was perceived (Thielsch & Moshagen, 2015). The responses differed for the web and mobile versions of the LMS. Majority of the students stated that the web version of the LMS was better in terms of the simplicity dimension. One of the students said:

"I think that the amounts and positions of the elements are appropriate because of the larger screen size."

Similarly, another student stated:

"The teacher wrote down course related information at the very beginning of the page. I didn't like it. It looks visually crowded, unnecessary and repellent to me."

One student criticized the elements in the web version in terms of its structure. He stated that the interface was too unstructured.

On the other side, another student found the interface structured by saying:

"[The amount of elements] looks appropriate. I think they are arranged date by date so it doesn't look problematic."

On the contrary, the perceptions on the simplicity of LMS were quite negative for the mobile version. All ten of the students stated that there were too many elements presented on the layout and it caused too much scroll. Some of the student statements were as follows:

Interviewees also commented on the ease of finding content, as it was one of the important indicators of the simplicity. Analyzing the answers; it can be summarized that majority of the students perceived the difficulty of finding the content in the interface as easy in the web version, one student found it difficult for both web and mobile versions of the LMS, and two of the students mentioned that finding the content was easy in both versions of the user interfaces, yet it was faster and easier on the web version. One of the interviewees said that she could find whatever she was looking for easily in the course page. Similarly, another student stated that she could scan more content at once due to the larger screen size on web screen; therefore, she found the web version way better than mobile version. Another student said:

"It is easy to find what I am looking for. It is arranged according to dates and looks very organized."

Another student said:

"Yes. I can. Finding the content seems easier in web version. I can look which proposal I need to submit and then I can quickly move to the other course so much easily and quickly. Finding the content is not difficult for the other one either, but in web it is faster."

An interviewee stated:

"On web, I can reach faster because I can see the sections on the sides. I can access the forums easily, when the instructor added an announcement I can see quickly. "

Majority of the students taught that especially the mobile version of the LMS was too dense, and there were too many elements presented so they could not find what they were looking for easily. Minority of the students found the number of elements presented in the web version too much. One of the students emphasized that she needed to scroll too much when there were too many courses on the dashboard of LMS. Another response of the students supporting this statement was follows:

"I didn't like scrolling down to the very bottom to reach dates in the mobile version. The problem for mobile is this: the amount of elements is more in web, but the screen size is larger. That is why element per unit area is less on web. It looks more crowded on mobile."

One interviewee said:

"The course overview section looks a little exaggerated. Only the need for scroll is bad. There is nothing that helps you to access content quickly on the mobile version because in the mobile, there is a linear website which you can access the content by only scrolling."

One of the students said:

"The menus on left and right sections are at the very bottom and in order to reach them we need to scroll down at the very bottom."

Another student stated:

"I cannot find content easily because there is too much content inside the course. It is harder to find these in mobile version."

4.2.2   Perceptions of Students in terms of Diversity Dimension of Aesthetics

Table 4.7: Qualitative Analysis of Diversity

Themes	Major Categories	Minor Categories	Person	
			Web	**Mobile**
Harmony in Elements	Diverse Elements	Pleasantly varied	10	0
		In Harmony	6	3
		Feels Uncomfortable	4	1
	Visual Elements	Inconsistent Font Types	2	2
		Inconsistent Font Sizes	2	2
		Colors are in Disharmony	6	4

The categorization matrix for the diversity dimension of the perceived visual aesthetics of the LMS is presented in Table 4.7. The students were asked to evaluate the diversity dimension of the LMS aesthetics. When the students were asked to evaluate the inventiveness and harmony of the layout, students were skeptical about the inventiveness of the layouts especially for the mobile user interface design. One student stated that mobile version was not inventive, and it was exactly the same design with the web version.

Another student also said:

> Especially on mobile, reaching the content via buttons and signs can be better. It seems like they designed an interface for web and adjusted exactly the same interface it in the smaller mobile screen. However mobile could have been designed differently where buttons are used.

When the interviewees were asked whether the different elements used were pleasantly varied in the user interface, which is an important indicator of diversity on an interface, some of the students criticized the user interfaces for not varying the layout aesthetically while some others perceived it as pleasantly varied.

One student said:

"I feel disharmony in here, there is a huge chaos in there. There are a lot of signs, different font types; sizes are all different from each other."

On the other hand, another student provided a different perspective to the aforementioned statement saying:

> In general, there is harmony. The only thing that may cause disharmony is caused by the lack of standards generated for the instructors while creating the course content. Some parts on the page look denser. Some teachers highlight the important parts with red; some wrote with black, s/he put a table, which doesn't fit in the page properly… All in all, it's not the disharmony of page but the disharmony of the content that the instructors created. Interface design is in harmony. Mobile is also in harmony.

4.2.3 Perceptions of Students in terms of Colorfulness Dimension of Aesthetics

Table 4.8: Qualitative Analysis of Colorfulness

Themes	Major Categories	Minor Categories	Person	
			Web	Mobile
Colorfulness	Color Combination	Pleasant	2	5
		Didn't Like It	8	3
	Color Suggestions	Should be Monochrome	1	1
		Prefer Vivid Colors	1	1
		Like Matte/Pastel Colors	5	5
		Red Color can be Used for Important Sections	8	8

The categorization matrix for the colorfulness dimension of the perceived visual aesthetics of the LMS is presented in Table 4.8.

In order to investigate the perceptions of the students on the color preference and combination on the user interfaces of the LMS designed for web, and mobile screens, the students were asked variety of questions. Whenever the students were asked whether they found the color preference of the user interfaces pleasant, except the two out of ten students, all the other students stated that they did not like the colorfulness of the user interfaces. However, the students stated that they perceived

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that the color combination and preference were better looking on the mobile screen, despite the fact that the color preference and combination were exactly the same on both of the interfaces. One of the students stated that she would prefer less pastel colors. She added:

"I would want it to look different. I am now used to it but when I first saw it I did not like it. It [the color] looks better in mobile version, in my opinion. Colors look more vivid, I don't know maybe it is due to the quality of mobile phone, but it looks better to me."

One of the students was not satisfied with the color preference as it made the LMS look like a PDF.

Another student stated that he did not like the color preference. He emphasized that the colors were looking slightly better on the mobile version of the LMS because he could not see all of the colors at once, yet he could see all the colorful sections one at a time as he scrolls down, that is why he was not annoyed by the colors in the mobile version.

However, he could see all the colorful sections at once on the web version of the LMS, which had been an eyesore for him. When he was asked how he would change the colors to make it look more pleasant, he stated that he would prefer monochrome colors: different shades of the same colors on the yellow, turquoise and blue sections of the LMS.

"I prefer more like monochrome colors, like…different shades of the same colors."

One student stated:

"In mobile, at least the colors that attract the attention needlessly have placed at the very bottom." When he was asked how he would change the colors to make it look more pleasant, he stated that he liked more matte colors and did not use the colors of latest news section."

Another student criticized the color preference for not evoking the passion to use the interface. He said:

It [the colors] does not build up passion to use the website. On mobile version, I believe the colors are less important than web because on mobile interface, the menus are not placed side by side and I cannot see them all at once. That is why I don't need to differentiate one element from another. I need to just scroll down to see each. It appears one by one. I need to check all of them for scanning. Whatever color the element is presented, I need to scroll to find it.

Contrarily, two students mentioned that they liked the colorfulness of the user interfaces. They said that the light background color increased readability of the texts but she stated that she found the mobile version worse. She suggested changing the dates with bold or red color in order to separate them from the overall content visually. He also emphasized the importance of colorfulness by stating:

"Whenever it [interface] is not colorful, it decreases the attractiveness."

The other student who was satisfied with the colorfulness of the LMS stated that she liked the colors, she said that the colors were very pleasant in both web and mobile versions of the interface and she added that the colors builds up passion to use it.

4.2.4 Perceptions of Students in terms of Craftsmanship Dimension of Aesthetics

Table 4.9: Qualitative Analysis of Craftsmanship

Themes	Major Categories	Minor Categories	Person	
			Web	**Mobile**
Professionalism	On Functionality	Too Much Scrolling	2	10
		Time Consuming	1	10
		Designed With Care	8	3
	On Responsive Design	Time Consuming/ Hard to Find Content	1	10
		Not Creative	1	7

The categorization matrix for the craftsmanship dimension of the perceived visual aesthetics of the LMS is presented in Table 4.9.

Opinions about the perceived topicality, sophistication and the professionalism of the design were investigated through a number of questions. When the interviewees were asked whether the interfaces seem to be designed professionally and with care, the majority of the students were positive about the issue. The students thought that the web version of the LMS was designed professionally, and with care more than the mobile version. The positive notions about the craftsmanship of the interfaces are introduced in the following section. One of the interviewee stated that both web and mobile interfaces of the LMS ere general Moodle based templates so she thought it was professional. When the interviewee further asked how she would change the

website to look more professional and if the visual aesthetics matter for professionalism, she stated:

> Yes appearance is of course important [for professionalism]. But this website is not very visual. If I were designing this website, I would put large buttons like we see in some mobile applications. Like Integra, it is clear what you are supposed to do with a few simple elements. Similarly, here also, latest news can be a button, and when clicked only the related information can be displayed and other distractive content can disappear. I would do such things. I find it nonsense to list each week one under the other. It is unnecessary. Instead of that, there might be a larger tabular calendar and if there are activities, some red signs can be placed on those weeks as a reminder. Because in order to find out that there is content under a week, I need to click on that week first. It does not lead you on the left menu where weeks are listed.

Some of the interviewees also mentioned the responsive design of mobile user interface of the LMS as being designed without giving so much care. Similarly, another student said that the mobile version was not designed with care when it was compared to web. He added that it seemed like they took the web version and fit it in mobile. Another student said:

"It [mobile user interface] seems like it is directly taken from web version and fit in mobile. Therefore, it didn't look professional. Web looks more professional."

Similarly, one of the students stated:

> I like its design but mobile could be different. When I first open the page I might see the widgets, for example buttons could be used. "Content is the same. I see the same thing in a narrower smaller form. It could be designed with android maybe instead of retrieving the html.

Another student criticized the craftsmanship of both of the interfaces stating that the interfaces seemed unprofessional and the main purpose of the site seemed like placing whatever needed all in the website as if esthetics was not the primary concern.

One of the students criticized the large fonts stating that the mobile version could have designed more diligently. She said that it seems unprofessional when the fonts get bigger.

On the other side, one student said:

> Hmm… this website [web version] is not designed negligently, but I would prefer it to be different in terms of color. But in terms of finding things inside, I think that is quite organized. However, you might not want to spend so much time using this LMS and that is due to the color-like features.

When the student was further asked to comment about the professionalism of the mobile version, she said:

> I think it is good because sometimes when designers try to adapt web version to the mobile version, the fonts do not fit in the monitor and they cannot adjust the elements properly, here I have never such problems. So I think it is professional.

4.2.5 Perceptions of Students in terms of User Interface Preference and Willingness to Use

Table 4.10: Qualitative Analysis of UI Preference

Themes	Major Categories	Minor Categories	Person	
			Web	Mobile
Justifications of User Interface Preference	Reasons of preferring	Very Clear/ Very Organized	6	1
		Practical/ Easy to Use	9	1
		It is Portable	0	2
	Reasons of not preferring	Scrolling Too Much	2	10
		Disordered /Crowded	2	10
		Colors are unattractive	2	2

The categorization matrix is presented in the Table 4.10 to analyze the qualitative data. In order to understand the students' point of view in terms of their interface preference and willingness to use, they were asked whether the web and mobile versions of the LMS evoked an interest in using them, majority of the student stated that they prefer to use the web version due to several reasons that were reported in the following section. One of the students stated that there were two reasons for preferring the web version. She explained that the first reason was that she could see the tasks she needed to very clearly in the web version, while she could fail to notice some important things when she was scrolling on the mobile version. She explained

the second reason, as clear and well-organized structure of the content presented in the web version of the LMS. Another student stated that he preferred to use web version usually. He also explained why he did not prefer to use the mobile version of the LMS by saying:

> I am not passionate for using this website, it is related with its look. It is too crowded. It disturbs me a lot. I mean everything is unorganized. And the design is maybe too simple. ...everything is so formal. I find it too businesslike. In order to learn something, it should look pleasant to me. It does not awake any feeling like using it, not at all.

Similarly, another student said:

"I would prefer to use web. I can deal with things by drag and drop on web. I can use the interface more easily. She explained that navigation bar was at the very bottom of the mobile interface of the LMS, so she needed to scroll."

Surprisingly, one of the students stated that she would prefer to use the mobile version of the LMS and that she likes denser interfaces. She suggests:

> Usually, if I have time and looking at things on LMS, I like to use mobile. Okay, it is more comfortable for me to use web but this is useful because you can keep it with you all the time. That's why if I am looking for something that I can download or easily search, I prefer to use the mobile version. There is another advantage of mobile which looks more crowded than web. I prefer more crowded interface like the mobile version to the web version, which has more white space so mobile is more preferable to me.

4.2.6   Perceptions of Students in terms of the Effect of Aesthetics in Learning

Table 4.11: Qualitative Analysis for the Effects of Aesthetics

Themes	Major Categories	Minor Categories	Person
Aesthetics	Finding Content	Highlights Important Sections	6
		Affects Positively	10
	Learning	It Affects	9
		Attracts Attention	8
		Motivates to Finish Tasks on Time	4
		Help Memorize	3

The categorization matrix is presented in the Table 4.11 to analyze the qualitative data. With the intention of investigating the perceptions of the students about the effect of aesthetics in learning, students were asked an interview question about the issue. All of the students provided arguments explaining how aesthetics of the design can enhance learning. The responses of the participants show that the visual design may enhance learning in three ways: by easing the Access to the necessary and relevant information, by improving motivation to study, and by contributing to learning.

All the interviewees stated that the aesthetics of the user interface of the LMS affect their learning by helping them to find the required information easily. One of the students stated that colors and highlights help her to find important things and

differentiate between different contents. Similarly, another student states that he could find the information he was looking for easier if fewer elements are presented in the user interface.

One of the students explained the importance of aesthetic in differentiating among the content by stating:

> I already said that when the faded it shows that that section is less important, then I pass/eliminate that section quickly. But when it is bold I think that I should pay attention to here, dates are important, or when it is red, I immediately look at there, and then I look at the rest of the content. Therefore, I think it is important.

Another student mentioned the importance of highlights and effects in finding the content. She explains that:

> Changing the color, emphasizing with bold, or italic attracts students' attention. I expect teachers to use bullets, emphasizing, deactivating sections or activating sections. When you see a straightforward text, you get bored. Dividing the text into paragraphs, and I can see more clearly. Colors also help this.

One of the students emphasized the importance of visual elements in learning things by referring to the visual memory as follows:

> It is hard to read a text with the same color same font size when compared to a text with schemas, symbols, images, so it affects my learning because there is something called visual memory. Whatever you see and read is remembered easily. When you see and read, what you see supports what you read.

Similarly, an interviewee stated:

> It [aesthetics] definitely affects [learning]. Especially I am a person who can easily get bored, so instead of looking at a boring interface for a long time, I prefer looking at a website that looks more pleasant and I can study for a long time so it allows me to learn in a shorter period of time.

One of the students pointed out a specific aesthetic design of web based learning interface that helps to organize information. He said:

> It [aesthetic] affects [learning]. There are websites especially new ones that are designed to display a section related images and backgrounds while you scroll so that you can understand you are in different sections. If mobile version can be designed like that, differentiating between different contents can be easier and striking. You don't get lost and it can expedite learning or at least achieving to learning.

An interviewee mentioned the effect of aesthetics in attracting the attention, which is very crucial for learning. She articulated:

> ...enhancing aesthetics will help attracting the attention of students more. I think symbols, and icons should be used so that the students can easily understand and it attracts the attention. Also learning because you can embed videos in here. Using that sort of contents, the visual materials help students comprehend.

Only one of the students stated that the perceived aesthetics of the user interface could have an effect on motivation hence, learning.

CHAPTER 5

CONCLUSION, DISCUSSIONS AND FUTHER STUDY

In the last chapter of this thesis, a brief explanation of the study is presented. Then, the research questions are discussed in detail and interpreted with the help of quantitative and qualitative data analysis results in the discussions section. Following the discussions, conclusions, limitations of the study and recommendations for the future research are introduced, respectively.

5.1   Summary of the Study

Although there is a myriad of studies in the literature focusing on the impact of interface aesthetics on user behaviors such as purchasing online, visiting a website, and performance on a task; a very limited amount of research has been conducted on the importance of user interface aesthetics in education, and the differences between the perceived aesthetics of web and mobile versions of the user interface. Due to limitations including screen size, the same aesthetic dimensions can be perceived differently when it is presented in web screen and mobile screen. In this research study, perceived aesthetical differences between user interfaces designed for web screens and mobile screens were investigated. An embedded experimental approach was used for the research analysis. As for the first step, the most frequently used tasks on ODTUClass are determined and course-specific navigational tasks were created based on that information. Following the creation of tasks, each randomly selected course was designed according to the tasks so that all the students could do the same tasks on different course pages. There is very limited amount of studies in the literature about how effective the general design principles can be applied on mobile devices. It is usually assumed that the aesthetic design of user interface will

be perceived the same way regardless of the features of the device. For these reasons this thesis focused on how differently do the learners perceive the same visual aesthetic design of two different user interfaces: web and mobile. For measuring the perceived aesthetics of both user interfaces; an aforementioned valid and reliable instrument was preferred, and quantitative data was gathered through this 7-point Likert scale questionnaire named VisAWI. The questionnaire mainly has chosen the aesthetic dimensions that can be measured consistently, and can both measure the aesthetic pleasure as well as the professionalism. These dimensions were categorized as simplicity, diversity, colorfulness, and craftsmanship.

After the task completion, VisAWI was used for measuring the aesthetics of the learning management system, but a further qualitative data was collected via the interview guide in order to support the findings.

The analysis has started with the quantitative researched followed by a detailed qualitative research for the purpose of strengthening the results of the analyses and for enhancing the answers to the following research questions:

- Is there a difference between students' perceived aesthetics of web and mobile interfaces of the LMS with regard to the Visual Aesthetics of Websites Inventory (VisAWI).

  o Is there a significant difference in perceived simplicity dimension scores of web and mobile interfaces?

  o Is there a significant difference in perceived diversity dimension scores of web and mobile interfaces?

  o Is there a significant difference in perceived colorfulness dimension scores of web and mobile interfaces?

  o Is there a significant difference in perceived craftsmanship dimension scores of web and mobile interfaces?

- What are the overall perceived aesthetics of web and mobile versions of the LMS?

- What are the students' opinions about the effects of visual aesthetics of the LMS on learning?

Findings of the study showed that;

- There was a significant difference between the perceived simplicity of the web and mobile interfaces of the LMS.

- There was a significant difference between the perceived diversity of the web and mobile interfaces of the LMS.

- There was no difference between the perceived colorfulness of the web and mobile interfaces of the LMS.

- There was a significant difference between the perceived craftsmanship of the web and mobile interfaces of the LMS.

- Students perceived both interfaces aesthetically better than the average.

- Students found the web interface of LMS better than the mobile user interface

- Students find the web interface simpler than the mobile interface.

- Students perceived the colors of mobile user interface better than the web interface although the colors were exactly the same.

- Majority of the students expressed that aesthetics of a learning material can enhance learning, or motivate them.

5.2   Discussions

5.3   Interpretation of the Results

5.3.1   Interpretation of the Quantitative Data Analysis Results

The first research question focuses on perceived aesthetic value of each dimension including simplicity, diversity, colorfulness and craftsmanship have been measured and the separate results of each dimension showed that all the aesthetic dimensions

of the user interfaces are perceived as well designed, yet the simplicity, diversity, colorfulness, and craftsmanship dimensions are all perceived slightly less well-designed for the mobile version of the user interface. Also, diversity-meaning the harmony of different user interface elements and the perceived inventiveness of the user interface was the least successfully designed aesthetic dimension compared to the other 3 dimensions. Colorfulness has the highest mean value for the mobile user interface aesthetics, meaning that students have perceived the color preference of combination of colors as the most successful among the other aesthetic dimensions. Similarly, simplicity dimension was perceived the most successfully applied aesthetic dimension in the web version of the user interface design.

The second research question focused on the perceived overall aesthetics of web and mobile versions of the LMS. A quantitative research method was used for finding an answer for this research question. The results of the analysis provided evidence that the participants find both web and mobile versions of the LMS aesthetically above the average. This is a very valuable result because it was mentioned in the prior chapters that the literature anticipates the positive effects of perceived aesthetics of learning materials on motivation, comprehension, performance and learning by evoking positive emotions on learner. Heidig et al. (2015) also have focused on the emotional design for the user interfaces and their effect on the motivation and the effects of the emotions on complex learning processes.

The study also revealed that the students perceived both overall aesthetics and individual aesthetic dimensions of web and mobile versions in a different way, despite the responsive design, the same colors, and the same content.

Based on all the statistical analyses, the answers to the first research question can be summarized as; there are significant perceptional differences between web and mobile versions of the same LMS having relatively similar-almost the same visual design. The design of the mobile user interface is no different than the web version, yet due the smaller screen issues, the web user interface design was adjusted according to the responsive design standards for fitting exact same content and

visuals on smaller screens. Despite transferring exact same user interface to the mobile version, the participants have perceived the visual aesthetic dimensions of a user interface design in different ways. This may have a significant impact on the students' motives to use the LMS frequently, effectively, and mentally involved with their full potential and to decide which interface they will prefer to use. The results showed that majority of the students have preferred to use the web version of the LMS due to its perceived aesthetics. There is a relationship between enjoyment and the intention to use a mobile device along with the perceived ease of use (Zhu et al., 2003). Similarly, Schenkman and Jönsson (2000) mentioned that aesthetics of interface has direct influence on the individual preference of web pages.

Further research on the study has been conducted through qualitative research method and the students' comments and reflections are mostly aligned with the quantitative data. Also the qualitative data sheds light to the quantitative data results by providing detailed information about some issues.

5.3.2 Interpretation of the Qualitative Data Analysis Results

As mentioned in the previous chapters, the third research question was expected to be explained with the help of the qualitative data collected with the participation of 10 CEIT students who have contributed to the study with his or her participation in VisAWI. In addition to this, the analysis also revealed further comments, and responses explaining some of the quantitative data results.

Further comments of the interviewee provided an opportunity for finding a link between the data gathered through the quantitative and the qualitative studies. As it was explained in the previous section, the quantitative data results illustrated that although the overall visual aesthetics and individual aesthetic dimensions are perceived as well-designed and successful, there were slight differences between the perceived aesthetics of mobile-specific and web-specific user interfaces. One of the results of the quantitative study showed that the overall visual aesthetic design was perceived above the average both for web and mobile versions. The interviews also

supported this finding. Majority of the students stated that they find web version of LMS aesthetically pleasing. Surprisingly, although the quantitative analysis results show that the students found the craftsmanship, and simplicity of mobile version quite well designed, most of them stated that being obliged to scroll so much makes it hard to access the information, is time-consuming and decreases its sophistical design. That is why, all the participants articulated that they prefer to use web version of LMS.

The analyzed interviews pointed that the students have found the mobile version of the user interface dense by stating that there were too much content and they needed to scroll too much. By looking at the interviewee statements, finding the content takes more time in mobile user interface compared to the web version. One student stated that he could not find the content easily on mobile user interface, because the interface was too disordered and finding it was time consuming.

Another student emphasized that it was not difficult to find the content in neither of the interfaces but it was faster in web version. Similarly, one student stated: "There is nothing that helps you to access the content easily on the mobile version." These findings also explain the quantitative findings illustrating that the simplicity of the web version of the user interface design was perceived more successful than that of mobile version.

As reported in the quantitative analysis results section, the results showed that participants perceived the colorfulness dimension of the visual aesthetics have been the highest rated dimension for the mobile user interface. Surprisingly, majority of the students stated that they did not found colors pleasant. Participants also provided further explanation about the perceived beauty of color preference and color combination, and it can be said that majority of the students perceived the colorfulness of the mobile version of LMS more positively than the web version although the color preference and the combination were exactly the same in both web and mobile user interfaces. One of the students stated that the colors looked better on mobile.

Another student also stated that he did not like the color preference and the colors looked better on the mobile version of the LMS as due to the scrolling limitations he saw one part at a time therefore the colors did not annoy him.

Similarly, one student emphasized that the colors looked better in the mobile interface. They looked more vivid, perhaps due to the quality of the mobile phone.

These findings also can provide an insight on the perceptional differences on visual design elements between larger and smaller screens. Because there is an ongoing discussion about the possible positive effects of aesthetics in learning, designing a web and mobile user interface for the learning purposes is a crucial concern for enhancing learning. However, it is a common judgment for instructional designers to assume the visual design principles are compatible with the mobile devices as well. However, these findings suggest counter arguments on the subject matter.

Another purpose of the qualitative part of the research was to find answers to the following research question:

Research Question 3: What are the students' opinions about the effects of visual aesthetics of the LMS on learning?

Interviewees provided very valuable information about the effects of aesthetic designs of the LMS on attracting the attention, and stimulating the responses. One interviewee said: "…I have to look for the important things and events. The web version pushes me to complete important events and tasks by reminding and attracting the attention." The same interviewee however expressed negative impressions on mobile user interface by saying: "On the mobile version, whenever I am scrolling down or up I might fail to notice some important things. It already catches my eye and can easily be seen on the web version."

Taking all the statements of the interviewee into consideration, except one of the students, all the students think that the aesthetics of a user interface affects their learning either by attracting their attention, enhancing their comprehension,

motivating them, fastening the learning process, or contributing to their visual memory. The results are also consistent with the literature. Miller (2011) also found that the learners who were exposed to a highly aesthetical instructional environment outperformed the learners who were assigned to the low-aesthetic group in the experiment. Similarly, Lin and Gregor (2006) stated that aesthetic design was the most crucial thing for fostering the pleasure of learning. Pace (2004) emphasized that the visual appeal is one of the dimensions that affects and maintains the "concentration under some circumstances". Al-Samarraire et al. (2016) reported the significance of system representation and perceived readability and memorability. Botta (2010) suggested that the structure of the website affects the user's ability to remember the content. Salimun et al. (2010) reported that the user's performance on the visual search task is in direct proportion to the aesthetic level of the interface.

Other interesting findings contradicting with the quantitative data results were; although the VisAWI results showed that the simplicity of the mobile user interface was quite well designed, surprisingly, majority of the interviewee found the mobile version of the user interface design very dense, time-consuming and difficult to handle. For instance, students stated that the problem with mobile interface was that the amount of elements were perceived as more on the mobile interface because the element per unit area was less on the web interface, which caused visual crowd in the

VisAWI results revealed that there was no significant difference between the web and mobile user interfaces in terms of color preference and combination. Nevertheless, majority of the interviewees mentioned that they perceived the same color in a different way.

Overall, the most mentioned statements that will be used as an answer for the research questions are that:

- The web design looks professionally designed, while the mobile version is not.

- Density of the objects on especially in the mobile version of the interface evokes negative feelings about the learning material.

- Visual elements used in LMS with the intent of highlighting important tasks, warning about the upcoming events, and homework fosters the emotions and motivates for task completion.

- Color preference and color combination perceived as better looking in the mobile version of the LMS.

5.4   Conclusions

In conclusion there are inestimable findings existing in the literature that drives the effect of aesthetic design on learning, comprehension understanding skills either by catalyzing the positive emotions, or by attracting the attention with the use of visual grammar. Qualitative findings of this thesis are also aligned with the literature. All the participants have mentioned that they are either positively or negatively affected by the visual aesthetics in terms of understanding, and learning a subject. In the literature it is found that the students prefer to use aesthetically attractive educational designs because they become motivated to perform with their full potential, understand the challenging tasks easier, and learn better because the colors, images, when affectively used decrease cognitive load by explaining things easier and by highlighting important parts of the information presented.

Important findings of the study are summarized as follows:

- Students have found both user interfaces of the LMS better than the average, yet they perceived mobile interface slightly less aesthetical compared to the web interface.

- Students value the power of aesthetics of the LMS in learning and agree that it contributes to learning by increasing motivation, enhancing comprehension, triggering visual memory, and by organizing information in a meaningful manner.

Students' perceived aesthetics differ based on the device used. The perceived aesthetics of web version of the LMS and mobile version of the LMS were significantly different although the aesthetic elements were exactly the same for both of the designs as it was a responsive design.

There might be several drawbacks of underestimating the differences between two interfaces and using such a design:

- The students might perceive aesthetics of the interface in significantly different way, which may reduce the power of aesthetics on the efficiency and effectiveness of learning material.
- Aesthetics is important for user experience and triggering emotions. An aesthetically poor design may evoke negative emotions on the user and result in a low quality and negative user experience, while the designer or instructor was not aware of the situation.

5.5   Implications for Practice

This study was conducted in order to understand the variety in perceived aesthetics of the learning management system used in METU, and to understand the opinions of students about the effect of aesthetics on their learning. However, the participants

selected were studying in CEIT department at METU, hence the cultural background of the students were quite similar. Therefore, interpretation and generalization of this study over the entire population would be a risky approach. However, the findings illustrate quite large amount of consistency with the suggested estimations in the literature and implications for practice could be suggested.

Both quantitative and qualitative results of this study showed that there is a significant variation in the perceived aesthetics of web and mobile versions of a responsive user interface design. It is understood that although the aesthetic dimensions of both interfaces such as color, and the content amount were kept constant in the design, a user can perceive two aesthetic dimensions in different ways. Therefore, the designers might take this finding into consideration and threat web and mobile user interfaces differently throughout the design.

Another implication of this study is to design the learning materials highly aesthetical so that the information transfer will work effectively and efficiently. Both the literature and the results of the study provided an initial evidence for the fact that aesthetic elements are quite powerful for evoking positive or negative emotions on the users. One of the mostly mentioned aesthetic elements on the issue is color. Therefore, using specific colors might worsen the learning by evoking irritating emotions or enhance learning by evoking positive emotions. Although there is no accounting for color taste, being cautious about using specific colors and having knowledge about the language of color will enhance learning via a user interface.

Aesthetic of a user interface should not be considered only as looking pleasant but also as how professional it was designed and how easy it is to grasp the interface. Therefore, presenting the learning content such as texts, tables, and figures is very crucial in terms of information transfer through an interface. The results of the qualitative data showed that although the students found the overall aesthetics of user interface as better than the average, the texts and visual elements inserted in the course page by the instructors might ruin the entire aesthetic design of the learning interface. In order to enhance student motivation and learning, instructors may

consider designing the course pages with care, and try to present information in a pleasantly looking way.

5.6   Limitations of the Study

Although the preferred instrument VisAWI was considered as a reliable, objective measure for interface aesthetics, it is ineligible on measuring more possible dimensions such as sound. Because the term aesthetics is a highly subjective manner, as the new definitions of interface aesthetics arise, much more dimensions can be added to the instrument. This way, the instrument might not be sufficient enough to measure aesthetics.

It is clearly stated in the VisAWI manual that being able to measure the perceived visual aesthetics in an objective way, the results gathered from the instrument cannot be generalized to the entire population due to some limitations. First of all, the participants chosen in this study were the students studying in Middle East Technical University, Computer Education and Instructional Technology department, which means that they were exposed to similar cultural experiences. For being able to generalize the research to the entire population, participants should be selected from variety of cultural backgrounds, from variety of countries, a variety of languages. Even if this requirement was met, there are countless of user interfaces that can provide different results, hence it is impossible to test all of the user interfaces.

Another issue related with this thesis was collecting the information about the effect of aesthetics and visual design on learning by interviewing with the participants. Contribution to this study was based on voluntary participation entirely as well as being anonymous. For these reasons, only 10 participants out of 113 participants accepted to spare time for further exploration on the second and third research questions with the help of their detailed explanations and opinions. Therefore, the validity of the qualitative data is based on the comments and responses of 10 participants who have also taken part in the quantitative research part of this study.

In order to improve this research study, repeating the study with variety of different participants and user interfaces and actually measuring the effect of visual aesthetics in cognitive system, motivation, comprehension and learning can be considered.

5.7 Recommendations for the Future Research

The research proposed in this study can be repeated with a larger number of student s varying from different fields of study, and cultural backgrounds. Although the used instrument for measuring the aesthetics of the user interfaces provides an objective measure for perceived aesthetics, it is not possible to generalize the findings. Therefore, the research should be replicated in different settings.

Secondly, the research that is going to be replicated can adopt an experimental research approach to see how the aesthetics of a user interface effect learning. In order to determine the effect of aesthetics in learning, an appropriate treatment for the learners is required. After the treatment, performance of the learners can be tested to determine the differences between the control group and the treatment group.

A third suggestion for the future study is that, all the students stated that the responsive design of the LMS decreased the professionalism of the mobile version of the user interface, which results in decrease in the overall aesthetic perception of the LMS. A future study can be conducted by changing the responsive design of the learning material with the mobile-specific application, also known as m-dot design, in order to observe if there will be any difference in terms of the perceived professionalism, and overall aesthetics of the LMS.

The fourth suggestion for the future study is to change the evaluated user interface because it is obviously not possible to generalize the aforementioned findings related with the effect of aesthetics in learning by solely investigating it using one learning material. Web and mobile specific user interfaces of a variety of different web based learning tools can be used, and the effect of their aesthetics on learning can be compared accordingly.

The last suggestion is to investigate the research questions with more participants. Due to the limitations of the voluntary participation, a limited number of students have provided data for both quantitative and especially for the qualitative parts of this study. The participants can be chosen from a number of different fields of studies. It is also mentioned in the VisAWI manual that the instrument can both be used for quantitative and qualitative studies. In order to further investigate the research questions, the participants chosen from different fields of studies can provide more detailed information to the questions provided as the items of 7-point Likert scale can be treated as interview questions of the qualitative analysis. However, this may take so much time and can be intimidating for the participants, hence the short version of VisAWI, known as VisAWI-S, can serve to that purpose.

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APPENDICES

APPENDIX A

Interview Questions

1. Which sections in the mobile LMS have you noticed density? Does the same section is dense as much in the web interface of LMS?
2. Do you feel that your performance was affected by the density of LMS?
3. How would you change the density of the interface so that it will look more aesthetically appealing?
4. Can you please compare the web interface of this LMS with the mobile interface in terms of simplicity and easiness to grasp?
5. Did you notice any difference between the web and mobile interfaces in terms of the inventiveness of LMS?
6. Why do you feel like the design appears uninspired or inspired on web interface? Do you think the same way for the mobile interface as well?
7. Can you explain the aesthetic perception that the diversity of web and mobile interface gave to you?
8. Please explain the differences that you have noticed in web and mobile LMS in terms of the attractiveness of color composition?
9. Why do you think the color combination and color composition looks better in the mobile interface of the LMS, or vice versa?
10. How can the color choices be changed in web and mobile interfaces so that it looks better?
11. Is the mobile or web interface of LMS layout appears more Professional?

12. Can you explain your feelings about the effect of the craftsmanship of this website on your aesthetic perception?

13. Which sections in the mobile interface and web interface of LMS are not designed with care?

14. Is there any feature that looks more Professional in mobile interface but not in web interface, or vice versa?

APPENDIX B

Sample Pre-VisAWI Task (Web & Mobile)

Task 1: Please login to ODTÜClass.

Task 2: Open the PDF document named "WEEK 5" under the week "November 9-November 15"

Task 3: Now, please close the document.

Task 4: Turn back to the CEIT213 course page.

Task 5: View your grades from the grade book on course page.

Task 6: Turn back to the course.

Task 7: Navigate to the calendar and check upcoming events for "All courses"

Task 8: Go back to the course page.

Task 9: Upload a blank word document to the Assignment under the week "November 30- December 6"

Task 10: Go to the "Week3 Lab 2 Assignment" under the week "October 26-November 1", and download the file if there is any.

Task 11: Navigate back to the main course page using the navigation under the banner/at the top

Task 12: View the Lab Attendance Sheet.

Task 13: View participants that are inactive for more than 3 days.

Task 14: View the profile of one of the participants listed, click to "Continue".

Task 15: Go back to the CEIT213 Course page.

Task 16: Add a new event

Task 17: Navigate to "2014 ODTÜClass Spring" from the ODTÜClass Archive.

Task 18: Go back to CEIT 213 course.

APPENDIX C

VisAWI- Visual Aesthetics of Websites Inventory / English

Please judge the present website according to the following statements on a scale ranging from 1 (strongly disagree) to 7 (strongly agree), thank you very much!

		Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1.	The layout appears too dense.	①	②	③	④	⑤	⑥	⑦
2.	The layout is easy to grasp.	①	②	③	④	⑤	⑥	⑦
3.	The layout appears well structured.	①	②	③	④	⑤	⑥	⑦
4.	The site appears patchy	①	②	③	④	⑤	⑥	⑦
5.	Everything goes together on this site.	①	②	③	④	⑤	⑥	⑦
6.	The design is uninteresting.	①	②	③	④	⑤	⑥	⑦
7.	The layout is inventive.	①	②	③	④	⑤	⑥	⑦
8.	The design appears uninspired.	①	②	③	④	⑤	⑥	⑦

9.	The layout appears dynamic.	①	②	③	④	⑤	⑥	⑦
10.	The layout is pleasantly varied.	①	②	③	④	⑤	⑥	⑦
11.	The color composition is attractive.	①	②	③	④	⑤	⑥	⑦
12.	The colors do **not** match.	①	②	③	④	⑤	⑥	⑦
13.	The layout appears professionally designed.	①	②	③	④	⑤	⑥	⑦
14.	The layout is not up-to-date.	①	②	③	④	⑤	⑥	⑦
15.	The site is designed with care.	①	②	③	④	⑤	⑥	⑦
16.	The design of the site lacks a concept.	①	②	③	④	⑤	⑥	⑦

VisAWI- Visual Aesthetics of Websites Inventory / Turkish

Lütfen incelediğiniz web arayüzünü aşağıdaki yargılara göre 1'den (kesinlikle katılmıyorum) 7'ye (kesinlikle katılıyorum) kadar olan skalada değerlendiriniz. Katılımınız için çok teşekkür ederim.

		Kesinlikle katılmıyorum	Katılmıyorum	Kısmen katılmıyorum	Ne katılıyorum ne katılmıyorum	Kısmen katılıyorum	Katılıyorum	Kesinlikle katılıyorum
1.	Arayüzün yapısı çok kalabalık görünüyor.	①	②	③	④	⑤	⑥	⑦
2.	Arayüz, kavraması kolay bir düzene sahip.	①	②	③	④	⑤	⑥	⑦
3.	Arayüzün yapısı iyi düzenlenmiş.	①	②	③	④	⑤	⑥	⑦
4.	Ekrandaki elemanlar düzensiz ve baştan savma görünüyor.	①	②	③	④	⑤	⑥	⑦
5.	Bu ekranda her şey birbiriyle uyumlu görünüyor.	①	②	③	④	⑤	⑥	⑦

		①	②	③	④	⑤	⑥	⑦
6.	Arayüzün tasarımı ilginç veya çekici değil.	①	②	③	④	⑤	⑥	⑦
7.	Arayüz yaratıcı tasarlanmış	①	②	③	④	⑤	⑥	⑦
8.	Arayüz tasarımı ilham verici değil ve kullanma isteği uyandırmıyor.	①	②	③	④	⑤	⑥	⑦
9.	Arayüzün düzeni dinamik görünüyor.	①	②	③	④	⑤	⑥	⑦
10.	Tasarımın farklı elemanları uyum içerisinde kullanılmış.	①	②	③	④	⑤	⑥	⑦
11.	Renk kompozisyonu göze çekici geliyor.	①	②	③	④	⑤	⑥	⑦
12.	Renkler uyumsuz bir şekilde kullanılmış.	①	②	③	④	⑤	⑥	⑦
13.	Renk seçimi acemice yapılmış.	①	②	③	④	⑤	⑥	⑦
14.	Arayüzdeki renkler göze çekici geliyor.	①	②	③	④	⑤	⑥	⑦
15.	Arayüzün düzeni profesyonelce tasarlanmış	①	②	③	④	⑤	⑥	⑦

16.	Arayüzün düzeni güncel değil	①	②	③	④	⑤	⑥	⑦
17.	Arayüz özenle tasarlanmış.	①	②	③	④	⑤	⑥	⑦
18.	Bu tasarımın bir konsepti olduğunu düşünmüyorum.	①	②	③	④	⑤	⑥	⑦

APPENDIX E

Table F.1 Themes and Codes in the Content Analysis of Interviews

THEMES	Simplicity	Harmony in Elements	Colorfulness	Professionalism	User Interface Preference	Aesthetics
	seen easier	harmony	color	professional	too much scroll	it affects
	amounts	disharmony	red	not designed negligently	very clear	definitely affects
	appropriate	chaos	yellow	unprofessional	very organized	not affected
	too much content	a lot of signs	turquoise	desktop	practical to use	important
	too much scroll	unorganized	vivid	mobile	easy to use	learning
	see all content	lack of standards	pastel	too much scroll	portable	reading
CODES	well-organized	desktop	darker/lighter shade	different design	disordered	legibility
	very organized	mobile	too white	buttons	crowded	visual memory
	clearly organized	different fonts	monochrome	widgets	colors are unattractive	hard to read
	desktop is easier	color combination	desktop	android	download	cannot read
	faster in desktop	color	mobile	html	time consuming	easily get bored
	too complex	font sizes		embedded from desktop	smaller screen	attract attention
	too crowded			designed with care	larger screen	effect motivation

too dense			not professional		learn in a shorter period of time
takes time			same interface		really effective
time-consuming			same design		organize my learning
waste of time			not much difference		expedite learning
desktop					easily understand
mobile					help find content

APPENDIX F

APPROVAL OF THE ETHICAL COUNCIL-PAGE I

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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14 MART 2016

Gönderilen: Doç.Dr. Ömer DELİALİOĞLU

Bilgisayar ve Öğretim Teknolojileri Eğitimi

Gönderen: Prof. Dr. Canan SÜMER

İnsan Araştırmaları Komisyonu Başkanı

İlgi: Etik Onayı

Sayın Doç.Dr. Ömer DELİALİOĞLU "Öğrenme Yönetim Sistemlerinin (LMS) web ve mobil arayüzlerinin kullanıcı üzerindeki estetik ve görsel algısının araştırılması, karşılaştırılması / Visual Aesthetics of Websites Inventory" başlıklı araştırması İnsan Araştırmaları Komisyonu tarafından uygun görülerek gerekli onay **2016-EGT-029** protokol numarası ile **14.03.2016-30.07.2016** tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Canan SÜMER

Uygulamalı Etik Araştırma Merkezi

İnsan Araştırmaları Komisyonu Başkanı

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Prof. Dr. Ayhan SOL

İnsan Araştırmaları Komisyonu

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Prof. Dr. Mehmet UTKU

İnsan Araştırmaları Komisyonu

Üyesi

Yrd.Doç.Dr. Pınar KAYGAN

İnsan Araştırmaları Komisyonu

Üyesi

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APPROVAL OF THE ETHICAL COUNCIL-PAGE II

BU BÖLÜM, İLGİLİ BÖLÜMLERİ TEMSİL EDEN İNSAN ARAŞTIRMALARI ETİK ALT KURULU TARAFINDAN DOLDURULACAKTIR.

Protokol No: 2016 -EGT-029

İAEK DEĞERLENDİRME SONUCU

Sayın Hakem,

Aşağıda yer alan üç seçenekten birini işaretleyerek değerlendirmenizi tamamlayınız. Lütfen "Revizyon Gereklidir" ve "Ret" değerlendirmeleri için gerekli açıklamaları yapınız.

Değerlendirme Tarihi: 14-03-2016

Ad Soyad:

☒ **Herhangi bir değişikliğe gerek yoktur. Veri toplama/uygulama başlatılabilir.**

☐ **Revizyon gereklidir**

   ☐ Gönüllü Katılım Formu yoktur.

   ☐ Gönüllü Katılım Formu eksiktir.

   Gerekçenizi ayrıntılı olarak açıklayınız:

   ☐ Katılım Sonrası Bilgilendirme Formu yoktur.

   ☐ Katılım Sonrası Bilgilendirme Formu eksiktir.

   Gerekçenizi ayrıntılı olarak açıklayınız:

   ☐ Rahatsızlık kaynağı olabilecek sorular/maddeler ya da prosedürler içerilmektedir.

   Gerekçenizi ayrıntılı olarak açıklayınız:

   ☐ Diğer.

   Gerekçenizi ayrıntılı olarak açıklayınız:

☐ **Ret**

   Ret gerekçenizi ayrıntılı olarak açıklayınız:

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