RELATIONSHIP BETWEEN WEB PRESENCE AND USABILITY OF UNIVERSITY WEBSITE: THE CASE OF LIBYA

THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
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MUFTAH S SAIED SALEH

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Approval of the Graduate School of Natural and Applied Sciences, Atılım University.

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This is to certify that we have read the thesis **RELATIONSHIP BETWEEN WEB PRESENCE AND USABILITY OF UNIVERSITY WEBSITE: THE CASE OF LIBYA** and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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MUFTAH S SAIED SALEH

ABSTRACT

RELATIONSHIP BETWEEN WEB PRESENCE AND USABILITY OF
UNIVERSITY WEBSITE: THE CASE OF LIBYA

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Master's Degree, Information Systems Engineering
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Technology is still experiencing significant development in the area of communications and Internet services. Today's commercial and educational institutions cannot compete in their field and gain new customers without an adequate online presence and satisfactory usability of their web portfolio. In this highly competitive world, websites are one of the main areas of interest for largescale organizations to increase their level of competitiveness. Some of the most important aspects of commercial websites are their visual esthetics and their usability from an end-user perspective, and therefore both of these aspects are developed and subsequently exploited in order to gain the satisfaction, confidence and ultimately the business of its target users. In the current research, two methods of study were followed: user testing and satisfaction survey. Usability assessment was conducted through interviews held with 61 Libyan students who were assigned to study at Turkish universities. The sample group were divided into two cohorts. Cohort 1 consisted of 31 participants who performed five predefined tasks in order to determine the ease of use and efficiency of Libyan universities' websites. Analysis was performed of their task success rates, as well as the recording of participants' observations. Cohort 2 consisted of 30 participants who carried out the same tasks as Cohort 1, but were then asked to complete a satisfaction questionnaire. The study aims to help Libyan universities to improve their web presence and to learn about common issues regarding the advantages and disadvantages found with these university websites in order that they can benefit from each other's experiences. The

choice of websites was based on the global classification of Webometrics. At the 2017 start of this research, four out of the top five universities in Libya, ranked according to the Webometrics ranking system, were selected for evaluation in the current study. So as to make a fair assessment, each participant was assigned five similar tasks to be performed on the Arabic language interfaces of the four selected Libyan universities' websites. The survey consisted of a set of questions designed to prove the level of each websites' effectiveness. At the beginning of the survey, the five tasks to be conducted by the participants were described based on the chosen university websites, and then the respondents are asked to complete the survey. Participants in Cohort 1 reported experiencing many problems in the usability of the websites, in addition they stated a failure to meet the end-user requirements, even though the phrases and words on the website were familiar to the participants. On the other hand, according to the participants' observations and the method that they operated the selected universities' websites, the participants found the most easy to use websites belonged to Misurata University and to the University of Tripoli, with the most difficult to use websites belonging to the Libyan International Medical University and the University of Benghazi. This result was also noticeable based on the length of time it took the participants to accomplish their tasks on each website. Results from both cohorts highlighted the weakness of presence of the Libyan universities' websites. Participants in Cohort 2 were reportedly also dissatisfied with the Libyan universities websites as evidenced by their completion of the satisfaction survey.

Keywords: usability, university website, user testing, presence, evaluation

ÖZ

AKADEMİK WEB SİTESİNİN VARLIĞI VE KULLANILABİLİRLİĞİ ARASINDAKİ İLİŞKİ: LİBYA ÖRNEĞİ

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İletişim ve İnternet hizmetleri alanında teknoloji halen anlamlı bir gelişimden geçmektedir. Günümüzün ticari ve öğretim kurumları yeterli bir online varlık göstermezlerse ve web portföyleri tatmin edici bir şekilde kullanılabilir olmazsa kendi alanlarında rekabet edememekte ve yeni müşteri kazanamamaktadırlar. Bu son derece rekabetçi dünyada web siteleri rekabet düzeylerini arttırmak için büyük ölçekli kuruluşların temel ilgi alanlarından biridir. Ticari web siteleriyle ilgili en önemli hususlardan bazıları görsel estetikleri ve son kullanıcının bakış açısından kullanılabilirlikleridir; bu yüzden bu hususların ikisi de hedef kullanıcıların memnuniyetini, güvenini ve sonuçta iş kazanmak amacıyla geliştirilmekte ve daha sonra kullanılmaktadır. Bu araştırmada iki araştırma yöntemi kullanılmaktadır: kullanıcı testleri ve memnuniyet anketleri. Kullanılabilirlik değerlendirmesi Türkiye'de üniversite okumak üzere gönderilmiş 61 Libyalı öğrenci üzerinde yapıldı. Örneklem grubu iki gruba ayrıldı. Grup 1 Libya üniversitelerinin web sitelerinin kullanım kolaylığını ve verimliliğini değerlendiren önceden tanımlanmış ber görevi yerine getiren 31 katılımcıdan oluşuyordu. Analiz katılımcıların görev başarısı oranları ve onların gözlemlerinin kaydedilmesi yoluyla yapıldı. Grup 2, Grup 1'le aynı görevleri yerine getiren 30 katılımcıdan oluşuyordu ama sonrasında bir gruptan bir memnuniyet anket formunu doldurmaları istendi. Bu çalışmanın amacı Libya üniversitelerine ağdaki varlıklarını iyileştirmeleri ve bu üniversitelerin birbirlerinin

deneyimlerinden faydalanmalarını sağlamak için kendi web siteleriyle ilgili avantajlar ve dezavantajlar hakkında ortak konular üzerinde bilgi sahibi olmalarına yardımcı olmaktır. Web sitelerinin seçini Webometrics küresel sınıflandırmasına dayandırıldı. Bu araştırmanın başladığı 2017 yılında Webometrics derecelendirmesine göre en üstteki beş Libya üniversitesinden dördü bu çalışmada değerlendirilmek üzere seçildi. Adil bir değerlendirme yapmak amacıyla her katılımcıya seçilmiş dört Libya üniversitesinin web sitelerinde Arapça dilindeki ara yüzlerinde gerçekleştirilecek So beş benzer görev verildi. Anket her bir web sitesinin etkinliğini göstermek üzere tasarlanmış bir dizi sorudan oluşmaktaydı. Anket çalışmasının başında h

Katılımcılar tarafından yerine getirilecek beş görev seçilen üniversitenin web sitelerine göre tanımlandı ve sonra anketi cevaplayanlardan anketi doldurmaları istendi. Grup 1 katılımcıları web sitelerinin kullanılabilirliği konusunda birçok sorun olduğunu bildirdiler ve ayrıca web sitelerinde kullanılan ifadeler ve kelimeler katılımcıların aşina oldukları ifadeler ve kelimeler olduğu halde son kullanıcı gereklerinin yerine getirilmemiş olduğunu belirttiler. Diğer taraftan, katılımcıların görüşlerine ve seçilmiş üniversitelerin web sitelerini kullandıkları yönteme göre, katılımcılar kullanımı en kolay web sitelerinin Misurata Üniversitesinin ve Trablus Üniversitesinin web siteleri olduğunu, kullanımı en zor web sitesinin ise Libya Uluslararası Tıp Üniversitesi ve Bingazi Üniversitesi olduğunu belirttiler. Bu sonuç katılımcıların her bir web sitesinde görevleri tamamlamak için harcadıkları zamanın uzunluğu açısından da dikkate değerdi. Her iki grubun sonuçları Libya üniversitelerinin web sitelerinin varlık açısından zayıflıklarını vurgulamaktadır. Grup 2 katılımcıları da doldurdukları memnuniyet anket formunda görüldüğü üzere Libya üniversitelerinin web sitelerinden memnun değillerdi.

Anahtar kelimeler: Kullanılabilirlik, üniversite web siteleri, kullanıcı testleri, varlık, değerlendirme.

This work is a gift to everyone who participated in helping me to complete this study.

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CHAPTER 1

INTRODUCTION

1.1 Information Technology

Information technology (IT) is the use of computers, networks, storage and other physical infrastructure and hardware processes to create, store, process, secure and share various forms of electronic data [1]. In addition, information technology can be defined as new technologies in today's world and is based on two concepts: technical skill and the ability to handle data and objects.

The Internet was initially used as a weapon in the Cold War by the Americans some 50 years ago [2]. But since then, the Internet has been used in many areas for the benefit of mankind, and so much so that today we have reached the point of the Internet's irreplaceability in societal and commercial life. The Internet is one of the most significantly important aspects of information technology, with statistics showing that more than half of the world's population now uses the Internet on a daily basis [3]. Shopping websites, educational websites, as well as social networking websites and applications have helped spread the Internet to the ubiquitous global presence it has become today. After a relatively short time of Internet marketing, multimedia has increased exponentially through the Internet [4]. This is based largely on what can be obtained by users of the Internet from its various services in a timely manner. Millions around the globe now use Internet websites to find information that they seek far quicker than ever before [5]. Finding the information as desired by the end user in terms of the quality of that information and the speed of its retrieval is not an easy task due to the vast number of websites now in existence. Currently there are reportedly about one billion websites, but only a few could be said to reach the desired level of end-user satisfaction [3].

Previously, humans sought and gained information through printed magazines, newspapers and from public libraries, but today websites have become the primary means to disseminate information to the masses [6]. Via the Internet, users have the

ability to easily find and retrieve information from the Internet, almost without regard for location or time [7]. Through the creation of scientific and educational websites, web-based applications facilitate end users dealing with national and international institutions from the comfort of their own home, from the workplace, or even whilst of the move through the more recent rise in mobile telephony-based applications. Today's web applications tend to interact based on patterns taken from traditional programs [8].

Today's Information and Communications Technology (ICT) market is still growing significantly, and depends on extensive government support as well as increases in the general culture of information technology and telecoms [9]. In particular, this growth has facilitated acceleration in the global economy, the creation and demise of jobs and furthering of the era of globalization. The exceptional growth of the Internet has helped today's users to significantly exchange information through the application of their communication skills [5]. According to this rapid development of the Internet, which has clearly affected many areas, researchers and those familiar with Internet-based software have referred to this era as the information revolution. This ICT revolution has also had a significant effect on educational institutions, even though in many cases such institutions themselves created some of the earliest pages seen on the Internet [10].

1.2 Usability

Usability is the measurement of ability when interacting with a system or product such as a computer program, Internet website or electronic store, a book, tool, machine, or in fact anything that humans may interact with [12]. Usability testing is a way of establishing how easy it is to use something based on testing it with real users performing real-world tasks. Test users are therefore required to perform certain preset tasks under the supervision of researchers in order to discover what problems they face, if any, that cause user issues or where users experience confusion whilst using the service or product [13]. One of the essentials of usability testing is to provide test users with the necessary techniques and tools in order to start the process of testing usability or developing their skills in this area [14]. According to previous studies, usability is defined as the ability to employ specific product users to achieve

the aims of their satisfaction, based on the efficiency and effectiveness of the service or product within an agreed pattern of usage [15]. Usability engineering can create both the environment and the task as either artificial or real-world [16]. Usability establishes the level of user experience quality when interacting with products or systems, including websites, apps, or software, so as to understand its effectiveness, technical and process efficiency, and the general level of satisfaction from the user perspective. One of the most important factors affecting the ability to use a computer program or website is human-computer interaction.

Human-computer interaction is a multidisciplinary scientific field combining psychology, design, computer science as well as other areas, and is mainly useful for those studying or working in the fields of computer science and information systems, or for those who have an interest in designing user interfaces. Web-based applications have affected many areas of daily social and commercial life, providing access to all sorts of services and information to a varied set of end users with different characteristics and levels of knowledge, experience and therefore ability [17].

Like all systems, web systems need to be constantly evaluated, tested, updated, and have errors corrected in order to maintain and improve their efficiency and the end-user experience. Therefore, web assessment frameworks are largescale projects that investigate and propose the means to authoring processes to improve the quality of the hyperdocument [18]. The real challenge, however, is how to create a way to help guide Internet users to evaluate websites without wasting time unnecessarily [19].

1.3 Importance of Usability

Usability focusses on the specific quality of a designed and developed system that affects the delivery of integrated services to its end users. Several factors point to the importance of usability websites for large organizations such as commercial companies or higher education institutions such as universities. This is necessary in order to help place the organization in a competitive position through the acquisition of new customers, whilst saving money through increased efficiencies [12]. These factors largely depend on what new customers can get from these services, and the

level to which it matches their expectations. In recent years, there has been a growing emphasis on usability engineering [20], which is a new science helping assure that benefits are realized from websites that are relevant to the stakeholders. To this end, the Internet has permanently changed the ways in which organizations interact with humans [21]. Users are influenced by the interface design of websites in terms of the colors, font, font size, key phrases and ease of navigation employed in their design and presentation. Based on this, existing concerns can be found through various means in order to ensure that academic and educational websites are designed appropriately so as to reliably meet the end-users' goals [6]. Hence, incorporating guidelines for essential use is key to addressing usability when designing websites [6].

1.4 University Websites

Most universities in most countries worldwide have their own websites, but they vary tremendously in their usability and components. Educational institutions were among the first developers of websites in the past, although many institutions only aimed to have a basic presence on the Internet [22]. Websites can be used to quickly transfer and store information, and also to provide the necessary web-based services on an anywhere, anytime basis. More recently, educational institutions have begun to focus their attention on assuring that their websites' efficiency supports additional new student enrolment [22].

Educational institutions are, mostly, non-profit organizations that are concerned about the direction of their business and their effectiveness on the Internet [22]. From another perspective, universities are interested in attracting attention to their work and what they can offer, which thereby attracts more people to visit their websites. For such institutions, their websites can be described as a major component of a university's connection to the world at large and to their client base of (direct or indirect) paying students. Therefore, the goals of these sites have changed over time, and today aim to make the learning experience exciting for students. In order to garner support from their current and prospective students, university websites must be efficient so as to encourage users to revisit and use it over and over again [23].

University websites offer a number of services to visitors and students alike such as information on the various teaching departments, information about faculty members, admission requirements for prospective new students looking to study at the university, as well as place for faculty to promote their scientific publications. A key benefit to a university's website is the ability for users to access information from a single point [24]. This single point of access to academic information is fundamental, and web designers must meet this challenge in order to deliver a suitable website interface that is usable in a way that is appropriate for its various target end users [25]. In addition, universities' web portals represent their digital community worldwide because they provide services and updated information that adds value to what happens on campus [26]. In view of this, today's universities have a keen interest to set up websites that establish a significant presence on the internet and represent an attractive informational resource that is also easy to use.

The main reason for the establishment of academic websites is often to provide information to its end users, and this is achieved by way of offering a well-designed website for the organization [27]. Web designers face a number of challengers in this endeavor, such as being able to determine their target users' needs and anticipating user feedback. Ultimately, the aim is to make a website that is profitable, useful, is in line with and supports the business model of the organization, and is both accessible and well-received by the end users [28]. Websites must have an appropriate esthetic form in terms of the colors, font type, font size, and images etc. that it portrays. Therefore, attractive websites that are easy to navigate and find the required information are considered vital to the modern-day educational organization [22].

Due to the increasing number of Internet users and the tremendous pace of technological change, educational establishments' websites have changed aims over the years [29]. The design process has been influenced by several factors, the most important of which is the administration's aims for the site and what its target end users identify as their needs. Therefore, a website should be tested after each stage of its design and development. These days, one of the most important resources is time, so designers need to focus on creating sites that meet both the organization and the end users' needs in terms of its usability [5].

1.5 Importance of Usability to Universities Websites

In the midst of the competition between universities to increase their world rankings, they also aim to attract new students to use their websites. Therefore, the two basic factors of usability and accessibility have become well-established concepts that are used in terms of computer system user interfaces and more recently for Internet websites [30]. Accessibility is the ability of users to access and use the services and/or products; whilst the extent to which a website meets its users' goals is termed as usability [30]. In the context of websites, it is possible to identify and evaluate any website on the Internet using the methods and techniques of usability [31]. In addition, website presence is considered one of the main pillars of success of any university. Mustafa and Al-Zoua'bi [31] reported that determining the success of a website considering its usability is fundamental. This means that in order to meet the needs of its visitors, the site must be designed according to their desires; however, there are a number of critical factors that affect the development and performance of a good website such as the type of font used and the information included on the website [22].

Universities have an interest in the quality of their website's output. In terms of user interest and value of information, that is very much dependent on the quality of the website itself. Website quality is a new theme of measuring the assessment of software quality [32]. The quality of a website is based on elements such as the font type, font size, colors, images and key phrases used on its webpages, as well as the ability to render a quick response to resolve users' problems. Unfortunately, university website design is rarely based on the students' (users') needs, but mostly depends on the vision of the web designers and/or the universities' administrators [10]. Therefore, additional measures should be taken in order to bridge the gap between the site owner and its end users. User research focuses on the end users, and aims to elicit the views of users through modeling. The focus of user research is on readability design, the architectural design of the information, the design of the webpages and its search function methods, as well as the user interface that is described in terms of its usability [33]. Accordingly, websites will be more likely to receive the permanent satisfaction of its users if they are able to find what they are looking for with the presence of certain quality-related features [27]. Problems of

navigating between website pages is one of the most significant obstacles facing end users.

Interacting with a computer, whether a fixed desktop personal computer, a portable tablet pc, or even a smartphone, is a prerequisite for using the World Wide Web (WWW). The Internet, often referred to simply as "the web," offers a number of features such as complex navigation models, graphical user interfaces, and dynamic content which poses a complex set of challenges for its ease of use [35]. Universities have to take whatever steps they can in order to maintain a positive image through a variety of components, and the only way to do that is by taking advantage of the other examples available on the Internet [21]. This means knowing the advantages and disadvantages of other similar websites, and thereby benefiting from the experiences of others in order that website visitors experience minimal problems in using the site. However, academic studies on the ease of use of Arabic language websites, especially those of universities, have been very few in number [31]. For the current research, the top four university websites were selected based on their webometrics evaluation, which is the largest classification system of international university assessment, covering more than 20,000 universities worldwide based on a twice-yearly assessment in January and July [131]. The Webometrics Ranking of World Universities is an initiative of the Cybermetrics Lab, a research group that is part of Consejo Superior de Investigaciones Científicas (CSIC), the largest public research body in Spain [142].

1.6 Presence of a Website

Web presence, put simply, is the place or location on the WWW where a business or person is represented. The visual appearance of a website is essential to the success of any business that operates partially or fully within the online domain. The presence of companies and institutions on the Internet directly affects the way its customers, visitors and their partners are identified and interacted with. Assessing and measuring the status of institutions on the Internet provides a window to determine the level of success achieved through their online business. This assessment is useful in knowing the investment made through the efforts of organizations in the field of their online business and in how improvements could be

made to the business levels of that institution so as to move the business forwards [37]. A website is the equivalent of today's business card. However, becoming a recognizable name through a website takes much more than simply finding a spot to list the organization's contact information. The building of a web presence takes time, persistence and considerable effort [38].

1.7 Aim of the Research and Research Questions

The research questions of the current study were designed in order to analyze the factors that affect the efficiency, effectiveness, and satisfaction of Libyan universities' website users so as to determine the extent of their usability and knowledge offering in assessing the level of presence of each website. Two methods were employed in collecting data for the study, with the study group divided into two cohorts of participants. Both Cohort 1 and Cohort 2 performed the following tasks in order to determine the efficiency and effectiveness of the selected websites:

- Perform a search for the Department of Pediatric Dentistry in the Faculty of Dental Medicine.
- Find out what courses are offered at the Software Engineering Department within the College of Information Technology.
- Navigate to the Department of Pediatrics within the Faculty of Medicine.
- Find out if the university has a nursing specialty, and whether there are other disciplines offered under it.
- Navigate to the Pharmaceutics Department within the Faculty of Pharmacy.

The participants of Cohort 2 then also completed a satisfaction survey.

The following research questions are set out specific to each cohort:

Cohort 1:
1. Is there any significant difference between Libyan university websites selected and categorized as 1000s, 2000s and5000sbased on the presence index of webometrics in terms of tasks completion time?

2. Are there any significant interaction effect of the university presence category and age, education level and tasks variables?

3. What are the difficulties faced by the participants of Cohort 1 while using Libyan university websites based on task observation?

Cohort 2:

4. Is there any significant difference between Libyan universities websites presence group and satisfaction results?

5. Is there any significant interaction effect of the university presence category and gender, age, education, Internet usage?

1.8 Thesis Structure

The study consists of six chapters. Chapter I introduces the research and briefly explains the research themes. Chapter II reviews the literature on university websites, usability and web technology, and also provides background information on Libya's universities. Chapter III introduces the methodology used in the research. Chapter IV presents and systematically describes the results of the study's collected data. Chapter V presents a discussion of the study's findings, and to close, Chapter VI puts forward the researcher's conclusions to the study and future work recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Web Technologies

Webpages are widely used to share information between two or more end users. According to Tao [39], web servers and web programs impart customer service through computer programs by way of dispersal of reports and other data. Using the HTML fragment, certain tags are embedded and stored on HTML pages, and HTML pages are distributed upon receipt of a request from a user [40]. Most users consider web technologies to be defined as a convenient and simple framework for the search and retrieval of information, but the Internet faces problems and challenges such as data and financial security, requirements from system administrators and legal bodies, and the usability of websites. Also, Tao [39] explained that each web server utilizes an IP address, or area name, and a port number as distinguishing proof of its validity. Individuals utilize web programs to send information solicitations to web servers through the HTTP convention, and web servers running on server PCs either recover the requested information or send the subsequent HTML records back to the web programs to render. Tomcat, Apache and Internet Information Services (IIS) are the most prevalent web server projects, with Internet Explorer, Google Chrome, and Firefox the prominent web browser programs.

Radical innovations in webpage technology represents the significance of today's security and privacy issues. Chatterjee et al. [41] stated that the global reach of the technological web platform, together with the range for services it supports, makes it a powerful business exporter. However, achieving strategic and operational benefits depends on effective absorption. They also stated that the acknowledgment of operational and key advantages is dependent upon the successful osmosis of composite applications to ensure data privacy and technical security. Despite the growing role of communication, the global web remains largely uncensored, with

individuals and organizations free to create websites full of documents and links [43].

Webpages also aim to improve the education sector through correspondence learning and teaching via the Internet, which have now become regular practice. The adoption level of emerging website technology in academia is increasing. However, a major impediment to the practice of online education is the limited understanding of learners' features and the perceptions of the use of such technologies. Therefore, the connection between student learning styles and their preferences for educational strategy needs to be understood, and this includes solutions involving emerging web technologies [44].

Web destinations need to be inspected to evaluate the degree to which Internet innovation bolsters these models of change to improve website interactions for both internal and external users. Van Birgelen et al. [46] noted that electronic channels are not automatically converted to replicate traditional business processes and the high level of customer satisfaction. Limited impact of online demand was found on the general satisfaction of users, which contrasts with the traditional service dimension effect.

Webpages that are considered to be highly efficient acquire that status based on the communications outcomes and client satisfaction. Web destinations can powerfully react to client demands [52]. However, user interest and the ease of use of websites are key factors in accepting and defining the use of different technologies by companies, but this is just a belief and at the same time does not explain the behavior of users towards modern information technology such as the WWW [53].

2.2 Importance of Web Technologies

The data gained via an organization's online webpages about its clients, their needs and desires, and about their conduct are unified in the client's databases [54]. This means that data homogeneity is important for all institutions, with data consisting of the same attributes or that are similar to each other [55]. The information stored in databases about its users can be utilized to adjust an organization's offering based on its users' needs. An organization's webpage and its

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users can cooperate regardless of location and time. In creating its own site, an organization has the opportunity to include enhancements to ensure privacy and security and thereby improve service quality to its end users [56]. By developing the web skills of its employees, such skillsets are important for companies to ensure its marketing strategy meets the requirements for general browsing and for each of its components. According to Ţarcă et al. [54], the integration of web technologies has an important place in the process of accomplishing an organization's objectives so as to increase its level of competitiveness in the marketplace through engendering their clients' loyalty. Developing web services can lead to improved communications with an organization's clients [57]. These services reflect a constant adaptation of the organizational offering to continuously changing client requests and the need to enhance corporate services.

An organization can share knowledge through effective webpages as well as their business. As indicated by Varlan [58], communication and the Internet have become global, as the world advances towards a learning-based society. Communication affects the degree of our success, with the sharing of current learning, working in a virtual world, and the propagation of knowledge that affects individuals. Through Internet transactions and webpages, users can obtain knowledge and provide similar data for others regardless of their location. Many companies around the world have set up special tools through their web portal to help users to receive information about their services and products [59]. Even though webpages improve connectivity between clients, there are sometimes considerable barriers such as security issues. Organizations utilize the web for procurement, to develop through partnering frameworks, and to link their applications to other applications [60].

2.3 University Websites in Relation to Web Technologies

Research into online correspondence advancements for the internationalization of learning and education have concentrated on setting up web advances and the conceivable internationalization ramifications of existing usage of Web 2.0 innovations [61]. Therefore, benefiting from the experiences of others is important for the success of any university's website. Organizations operate in an increasingly

dynamic world and much of this dynamism is created through the application of technology, especially Information and Communication Technology (ICT) development or innovation. Some organizations enjoy this dynamic merit, creating new products and business models as their business thrives, whilst others attempt to ignore it, or try to adapt slowly over a long period of time [62]. Consequently, websites can support user desires by using certain Internet applications and tools. As indicated via Barnard [63], higher education is going through a period of high quality transfer. The comprehensive development of today's telecommunications represents a clear support for the growth of the Internet and the development of high quality tools in the hands of today's educators, where they can access vast amounts of visual, text, and audio data for almost all subjects.

Face-to-face learning experiences and communication with online experience is required in order to avoid webpages barriers. According to Dziuban et al. [64], university faculties are testing courses that utilize both fully online and face-to-face communication. Departments, students, and managers have reported several benefits from such courses, with many perceiving them to present the best of both instructional mediums with websites used to communicate with students. Communication represents the basic means of education for all groups. ICT provides researchers and educators with a learning environment and promotes and reinforces the learning process through integrated learning and other new concepts being developed [65]. Accessibility of Australian academic websites and a key site from each tertiary training web locale were analyzed in a study to measure their compliance with basic standards of the essential principles of accessibility, as required by Australian anti-discriminatory legislation [66]. Certain users were found to be unable to access information from websites such as the disabled and those with special needs. Alexander [66] found that most of the results showed that Australian college web destinations included significant obstructions that faced certain individuals with disabilities.

As stated by Fichten et al. [67], students reliably prefer that their instructors utilize ICT in their lecturing as well as for individual in-class and collaborative works. Students across all projects preferred most of the regularly utilized ICT's their instructors used such as PowerPoint, audiovisual recordings, and software content

management systems (CMS). Notwithstanding, the students disliked digital textbooks, online courses, communitarian work on the web, exchange discussions, web journals, chatrooms, texting, and all sorts of correspondence utilizing long-range interpersonal communication when utilized by university personnel such as the use of Facebook. Design guidelines are intended to enhance user interaction through large display screens and are developed with these in mind in order that future graphical user interface (GUI) product designs can significantly improve user productivity [68]. Students' views about what ICT-related experiences worked especially well or poorly for them are presented, along with their recommendations about what colleges and instructors need to change [67].

2.4 Importance of Usability for University Websites

The usability of university webpages has concentrated on user interfaces so as to avoid user dissatisfaction. According to a study by Hasan [10], many students were happy with the usability of college websites, their substance and site navigation, and their simple to use interfaces; yet they were dissatisfied with the overall design of the sites. Usability of sites plays a focal part in the establishment of reliable communication between colleges and their stakeholders. High levels of communication between the college administration and its stakeholders can enhance the administration from numerous perspectives. It was also declared that university websites act as a conduit for stakeholders to voice their concerns and to make requests of the college organization [21]. Website usability testing can lead to considerably enhanced client encounters on most university and college digital pages. Also, a significant portion of these websites are classified as having far less than the usability levels expected by today's Internet users [69].

Visually impaired students require the capacity to utilize college sites that educate them though open courses and occasional on-campus grounds. Therefore, university websites must be created especially to cater for these kinds of students [70]. The main issue for universities is to grant access to information without users experiencing undue problems. Ganiyu et al. [71] stated that the objective of each college site is to provide profitable scholarly data to its clients without difficulty. The concern is that sites may not be fully usable or may not meet prospective students'

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wishes. Additionally, most university webpages need to be adapted each semester. It is essential, therefore, to consider the simplicity of push forward/backward, prevention, the usefulness of links and new browser windows and of pop-ups. The negative relationship between interface design and the quality of the site refers to the less significant aspects of its planning, and of a website's learnability and utilization of agreeable hues in its interfaces. It is also fundamental to consider the stacking time of digital pages, and also of the accessibility of the site in order to judge the dependability of the data [72].

Radical innovation has enhanced many universities' webpages. This change has included the redesigning of sites to utilize the most recent innovations so as to enhance its usability [6]. This exploration was undertaken in order to discern the convenience level for website users through open assessment of government colleges. Webpage development requires software and hardware improvement to ensure success. According to Storey et al. [73], digital learning web tools provide coordinated situations with diverse advances to help meet teachers' and students' needs through the Internet.

2.5 Overview of Usability

The target of website usability is high-task performance, user satisfaction, ease of learning, and low error rates etc. [74]. Some organizations have realized profits by focusing on usability. Usability requires software improvement, and considers the effect of this quality attribute along with other quality properties in order to be managed within a configuration that creates reusable software at a sensible cost [76]. Therefore, usability while at the design stage in the software development lifecycle is important in order to reduce the overall time, effort and cost in developing based on reusable standards. Van Welie et al. [77] stated that while good usability of a framework is the primary objective of interface originators, decisions about usability are often undertaken at a later stage by performing usability tests with clients or based on actual experiences. Then again, planned rules and outlined heuristics can help designers to enhance usability while still at the design stage. They also reported that the agendas, tests, rules and so forth may contrast with the structure, substance and phrasing, and the recommendation is that one single list would be more helpful

than many. Bevan [78] stated that a user-centered design approach was required in user interface modeling. The greater part of the design measures determine the general standards as opposed to exact points of interest of an interface. User interface and usability norms are portrayed in the classes of usability definitions, utilized in settings, software interface and collaboration, equipment interface, documentation, the advancement procedure, and the ability of the association. Also, the quality factor cannot be overlooked as it is of significant importance to all parties. The usability of software frameworks has been perceived as an imperative quality factor. Numerous frameworks have been proposed to date for assessment, yet they remain uncoordinated and neglect to cover all areas of usability [79].

University webpages require certain tools in order to test performance standards and client's satisfaction. According to Tobar et al. [80], the advanced analysis and follow-up of the procedures designed to guarantee the usability and availability of sites is tedious work for moderators and evaluators. Today's university webpages can be accessed via mobile applications as a portable medium using an Internet connection in order to share university information and to make it available to all students. De Paula et al. [81] stated that mobile application design thinking should focus on user experiences in addition to usability rules and guidelines in the context of the students' setting. Portable applications should be created based on the philosophy of design-based thinking, which offers a complete and solid service and, most significantly, a straightforward user experience. De Paula et al. [81] reported on an application that was created by a group of inexperienced college students in computer science and design at a federal university. The application had received high achievement ratings, being the third most downloaded utility in the principal week and had ended up being made accessible through a mobile store. Additionally, the application scored high evaluations on sites focused on driving innovation.

The most essential point is to utilize easy-to-use interfaces based on recognized standards in order to simplified transactions between universities and their students. Although there are numerous individual techniques for assessing usability; there have not been many incorporated into a solitary theoretical structure that encourages the utilization of engineers in the field of user interface design. This is valid to some degree because there are presently a few unique principles (e.g., ISO 9241, ISO/IEC

9126, IEEE Std.610.12) or calculated models (e.g., Metrics for easy to use Standards in Computing [MUSiC]) for usability [82]. Moumane et al. [83] stated that the usability of portable applications can run on various versatile working frameworks, including Android, IOS and Symbian. In their study, they tested clients utilizing ISO 25062 and ISO 9241 guidelines for target measures working with two generally utilized portable applications of Google Maps and Google Apps. The survey aimed to gather measures evaluating the clients' level of fulfilment when utilizing these two portable applications. They featured an arrangement of versatile usability issues that were identified with the equipment in addition to the product, and that should be considered by designers and engineers in order to enhance the convenience of portable applications.

Earthy et al. [84] claimed that human-centered design forms for intelligent frameworks are characterized in ISO 13407 and the related ISO TR 18529. The publication of these standards are considered complete for user-centered design, the framework improvements group Human Factors as forms which can be overseen and incorporated through existing ventures. User interfaces, often called expert-based assessment, are characterized as a casual technique for usability investigation and is comprised of the logical examination of a predetermined, prototyped or existing interface, with the objective of recognizing ergonomic planning issues. They also declared that it depends upon the evaluators' skills (human components professionals, framework architects, software engineers, and so on) [85]. Mentes and Turan [21] reported on the existence of five assumptions of usability: efficiency, helpfulness, learnability, controllability, and attractiveness. In addition, as concluded from the five usability factors, four factors (helpfulness, efficiency, attractiveness and learnability) are said to be positively related to theoretical assumptions.
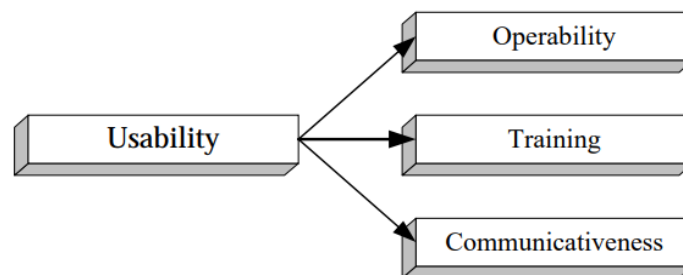
Figure 1: Usability perspective adapted from (Xenos [86]).

The following table describes certain ISO standards, as well as their intended use.

ISO STANDARD	DEFINITION	USAGE
ISO 9126	An international standard software quality model that helps in creating a solid framework for assessing software.	• Information Security Management
ISO 9001	A global family of standards, which includes a set of standards within the quality management system.	• Used to embrace various models and metrics
ISO 25062	Provides a standard method for reporting usability test findings.	• Usability test
ISO 9241	Provides a framework for understanding the concept of usability and applying it to situations where people use interactive systems, and other types of systems (e.g., built environments), products (e.g., industrial & consumer products), and services (e.g., technical & personal services).	• Interactive systems
ISO TR 18529	A standard developed by the International Standards Organization that defines a "Usability Maturity Model," which is a set of practices in the design lifecycle to be human-centered and involve appropriate evaluation.	• Human-centered lifecycle process descriptions

According to Xenos [86], the ISO 9126 standard on usability can be partitioned as understandability (which is the client's exertion for perceiving the fundamental idea of the product), learnability (which is the client's exertion for figuring out how to utilize the product), and operability (which is the client's exertion for task and activity control such as mouse bolster and full-scale summons). They also announced that ISO 9126 is utilized by numerous designers to characterize quality objectives and usability remains dependably a prime concern in software quality. ISO 9001 is a model for quality affirmation in outline advancement, creation, establishment and adjusting, where an agreement between two gatherings requires the exhibit of the provider's ability to plan and supply items.

The ten principles of Nielsen [87] of interaction with design are heuristics that represent general guidance:

1. Visibility of system status: The system should tell users what is going on permanently via comments in a timely manner.

2. Matching between system and the real world: The system should utilize the users' language, by words and concepts as well as user-friendly phrases presented in a logical and natural order.

3. User controls and freedom: The need for an emergency exit when users request functions by mistake and require clear sign-out of unwanted functions; Supports undo and redo functions.

4. Consistency and standards: Not to leave users at a loss as to whether the procedures and words are the same thing, which is avoidable by using the terms of the statutes.

5. Error prevention: An accurate design that prevents problems in the first place without need for complex error messages.

6. Recognition rather than recall: The user memory should not be loaded by visual procedures and should not remember dialog from one page to another, but should facilitate the ease of restoring visual instructions in a timely manner.

7. Flexibility and efficiency of use: There are often expert user interactions so that you can meet the needs of both experienced and inexperienced users. Enable users to design periodic operations.

8. Esthetic and minimalist design: Dialogue should not contain inappropriate or unnecessary information.

9. Help users to recognize, diagnose, and recover from errors: Solutions should be suggested constructively, symbols should not be used in error messages, and problems should be accurately identified.

10. Help and documentation: It is best to use the system without documentation, but that support and documentation should be provided as necessary. Such information must be easy to search for, be focused on user tasks, implement a list of concrete steps, and not be too large.

2.6 Usability Studies about University Websites

This section addresses the tools used to evaluate websites.

2.6.1 Heuristics Evaluation Studies

In recent years, heuristic evaluation has become widely used, and many users of this method are developing their own inference set [88]. However, in earlier research

by the author of the current study, it was found that few studies have been conducted on assessing the usability of university websites using heuristic evaluation as a usability method. The following are some studies where heuristic evaluation was employed.

Alotaibi [9] evaluated usability as a heuristic evaluation for Saudi Arabian universities with participation of 15 male and 15 female final and postgraduate students and practitioners from the information system technology department. The participants developed or evaluated the university websites based on seven points which are next visual design and consistency, links and navigation, data entry forms, information truth and precision, privacy and security, search functionality, and help and feedback to error and tolerance.

In another study, Kostaras and Xenos [8] explored usability through an all-expert group who evaluated a university website. The heuristic evaluation method proved effective with 38 usability defects reported. In addition, the applied method was considered effective in terms of both time and cost.

Hasan [15] evaluated three websites for Jordanian universities using two documents and developed task lists. The number of students who responded with acceptable data was 237, divided as 63% for males and 37% for females. Five residents participated in the study, along with two usability specialists and three Internet experts. The research comprehensively assessed using the websites of three major institutions; Hashemite University, Yarmouk University, and Jordan University. The results demonstrated that heuristic assessment methods were effective in identifying a significant number of usability issues that could be applied in order to improve various aspects of the universities' websites.

As in the current study, common methods of collecting information were used by Lodhi [89], who utilized two methods of survey and heuristic evaluation in performing usability testing with 50 college students and four experts who each voluntarily participated in the index evaluation of their university's website. As an experiment, the evaluation of the existing website was performed using Nielsen's usage reasoning framework in a usability survey where students had to rate their university, and then evaluated the university site by way of heuristic evaluation.

Some studies indicate that heuristic evaluation is one of the most frequently evaluator-based usability evaluation methods. Heuristic evaluation is an adjunct to guidance for one of the most widely used usability assessment methods [10]. Usability heuristics identifies usability issues in order to check the utility of the ideal change and the level of acceptance of changes. Usability is extremely significant for end users, and the motivation behind why checking with appropriate instruments for surveying usability in items like touchscreen mobile phones remains a clear requirement [90]. One ordinary usability assessment technique is the heuristic assessment, where evaluators utilizing usability heuristics identify usability issues. [91]. Three kinds of approval tests were performed, with request tests, heuristic assessments, and specialists' forms. Results bolstered and checked the utility of the ideal change.

Heuristic evolution is determining the avoidance of known website issues and problems through the application of a proven framework. According to Allen et al. [92], heuristic assessment led by specialists is particularly appropriate for developmental assessment as it can be utilized based on an outline in models of the application, and can be utilized within a framework of any current application in use.

University websites can be improved by paying attention to content and through constantly updating the data. According to Hasan [15], managers of academic establishments and instructive sites need to know the types of usability issues that could be experienced on their sites. However, there is an absence of published research which assesses the usability of instructive sites utilizing the heuristic assessment technique, especially with regards to Arabic language websites [10]. The power of technological website reusability is in using integrated standards in the university framework. Papadopoulos and Xenos [93] presented an assessment of a joint effort with specialists and evaluating individuals from programming quality and usability standard clients in order to draw parallel results. Easy to use interfaces can be represented throughout the implementation of the reusable webpage.

Major usability issues will rise over minor issues in a heuristic assessment; however, more minor issues can also be found in significant numbers. Heuristic assessment connected to a model execution is not especially powerful as it is harder

to identify missing interface components [94]. Hasan [15] reported on the extent of the use and influence of heuristic evaluation to detect events and their processes in relation to the ability to identify different types of problems that face educational sites such as problems of use. Unfortunately, there has been a lack of research evaluating the usability of educational sites in a meaningful and specific way, especially in the case of evaluating Arabic language university websites [10].

2.6.2 Studies Utilizing Automated Tools

Faustina and Balaji [95] employed many of the free web diagnostic tools available on the Internet for their data collection in a study of three websites selected from India. In addition, a set of specific criteria for evaluating the quality of each site was listed. Due to the inherently dynamic nature of websites, there can be significant differences in the results, but no dynamic changes were observed in their search, with the results indicating that the websites of the three selected universities worked well according to the preset criteria. Najadat et al. [23] conducted research and analysis on websites where most of the traffic generated by the website were applied using provided input, and tested the effort required to create, implement and maintain the website. In the study of Chamba-Eras et al. [96], 24 universities were targeted using data mining techniques, with the main objective being to explore the level of usability of university websites. Their design included a single-shot case and "observation method" was used in order to gather data on the efficiency, effectiveness, and learning based on a scale that used 10 questions to gather data on user satisfaction. The experiment was conducted in a controlled laboratory environment that was based on related work. In this context, the researchers used the system to evaluate the usability of the SIRIUS website in presenting a broad spectrum of standards from which 10 rubrics /aspects, including tools to generate site-specific accessibility ratings called Prometheus incorporated reasoning to perform this process, used the Prometheus tool to support evaluating the usability of websites using the SIRIUS rating system.

Kiyea and Yusuf [17] evaluated the website of a university in Nigeria using automated tools such as websites analyzer and HTML toolbox for data collection. In their study, various aspects of usability were addressed. Although some were not found to be at acceptable levels of performance, which included HTML validation

errors, browser compatibility issues, bad pages, poor load time or broken pages, the Nigerian university site was found to be reasonably acceptable based on the evaluation criteria applied.

Acosta-Vargas et al. [34] provided a study on the evaluation of accessibility to higher education websites using the TAW2 tool (https://www.tawdis.net) and the Examinator3 tool (http://examinator.ws/). They concluded that the majority of sites tested did not conform to acceptable levels of compliance, and that the university high-level academics were not interested in providing accessible information from the university through the website so that everyone could access it with or without deficit. Accessing university websites was seen as a major barrier for many users, as webpages should provide various options and presentations on their websites that meet the needs of the majority of users and must also be replicable.

Adepoju and Shehu [6] used the automated tools of Achecker, HERA and WAVE, and WCAG 1.0 and 2.0 in order to match websites by reporting violations of error format and other problems. They found accessibility errors on all websites they checked. In addition, they evaluated the websites' usability using three specific tools: HERA (www.sidar.org/hera/index.php.en), Achecker (http://www.achecke.ca), and WAVE (http://www.webaim.org). These same automated tools were then used in a joint assessment study of the usability and platform optimization suitable for eight Arab universities, and was performed by Al-Ananbeh et al. [97]. The universities covered by the research included both public and private universities. The main purpose was to identify specific usage problems such as HTML validation errors, loading time issues, browser compatibility issues, PageRanks sets, and so on.

Some researchers use more than one tool to analyze, search for data and obtain results. Iram et al. [98] reported on universities evaluated from the Punjab province of Pakistan and provided results according to evaluation criteria and the tools employed. A study by Zaphiris and Ellis [35] utilized two automated assessment tools (Bobby and LIFT) in order to measure the utility and access of the top 50 universities in the United States, with the results showing that most university websites have easy access to websites, low usage rates, and non-compliance rates of around 30%.

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Islam and Tsuji [4] reported that on Internet-based automated tools, namely HTML toolboxes, and webpage analyzers, as well as user questionnaires in examining websites. The automated tools were also used to measure internal functions such as HTML code errors and download times. In addition, a questionnaire was used as a data collection method in which a total of 200 users representing 20 different universities participated in the e-mailed evaluation questionnaire. Most of the participants ranged in age from 18 to 25 years old, with 73% male respondents and 27% female. The conclusion of the research was that websites failed to meet their users' requirements and expectations, whilst diagnostic Internet tools showed that the internal quality of these sites was not ideal.

This strategy was also used by Mustafa and Al-Zoua'bi [31] in a study to evaluate Jordanian university websites from the perspective of their usability. Two automated Internet tools were used (HTML tools and webpage analyze). Additionally, questionnaires provided for website users were formulated and designed based on 23 criteria divided into five categories. The study's results showed that the overall usability of the site was acceptable. Nonetheless, there were certain weaknesses in some respects of its design, interface, and performance. In the study, suggestions were made so as to strengthen the Jordan University's website. Ivory and Chevalier [99] stated that completed information looking at assignments within the first and modified locales, despite the reality of the apparatus, helped designers to recognize a larger number of potential issues, but designers were ineffective in translating and applying the rules. The modifications that designers made considering the instruments did not enhance client performance or appraisals [31]. It has been shown that usability is more important as the basic framework for individuals unable to physically attend an institution come to rely on the site [100].

The objective of a university website is to offer good quality services to its students. According to Mustafa and Al-Zoua'bi [31], developing websites through a few outline rules can all but guarantee that websites accomplish their objectives and expectations for operational perfection. An organization's website is an entry point to its data, products, and services. In that capacity, in a perfect world, websites should reflect the necessities of the customers it serves. Web architecture is frequently determined by innovation, authoritative structure or based on business targets rather

than by the client or end users' needs [101]. University website innovation is adapted to ensure security and privacy, as well as student satisfaction. Website designers therefore ought to include students in the site advancement process by assessing their thoughts and enabling them to take part in the acknowledgment testing since students are the essential clients of any Scholastic site. Scholastic is a US-based company specializing in media, publishing and education, and is famed for retailing and distributing educational materials and books to schools. Guidelines ought to be outlined and followed throughout the improvement procedure in order to guarantee consistency in the planning of any website [102]. The user interface should be able to be explored easily without causing any unnecessary client misunderstanding. The route configuration of a website should follow a level of consistency without pointlessly bewildering the end user. Considering that it appears that everybody is on the WWW [103], such an approach is considered basic customer-focused business logic.

2.6.3 Studies Utilizing Questionnaires

Through the use of specific topics or labels, a set of questions can be created, with pre-specified answers set, and then a study group of people identified based on a set search pattern selected to answer the questions. As presented in a research by Mentes and Turan [21], their study evaluated the usability of university websites as a case study of Kemal University in Turkey. Participants were divided into two groups based on their ages being "above middle age" or "below middle age," and whether or not they had used the Internet for a period of more than five years. The number of valid questionnaires returned was 339. The majority of the respondents were male (63.8%), with just over one-third female (36.2%). Some of the demographic variables such as gender and web experience were shown to have impacted on the trends of the individual users.

Hasan [10] focused on the evaluation of usability of a Jordanian university's website using five evaluators, as two usability experts and three network experts, who participated in the study. Questionnaires were applied to 252 students in order to assess nine websites from nine universities in Jordan. A gap was seen between the research and examining the applicability of Arabic language educational websites.

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Second, the problems of Jordan University, with a total of 2,926 issues related to website design, were deemed to be mostly common as they involved the areas of design, navigation, content, usability, and communications.

The main objective of a research study by Daher and Elkabani [104] was to test the feasibility of important services available through a university college portal and that faced users while using these services. The study focused on the difficulties experienced, with 120 faculty members participating through a questionnaire at nine different universities. The proportion of male respondents was higher than that of females, and the participation age varied between 33 and 63 years of age, with an average age of 44 years. The study was divided into two parts, with a questionnaire, and an extensive research using the SUM model as an individual measure to evaluate the efficiency, effectiveness, and satisfaction of the system's users; with an additional part as the user test. A powerful college portal can be easily obtained on the Internet by combining a number of elements, but one of the key elements in building a fully functioning university portal is advanced management and professional leadership for highly coordinated technology management. Also, Hasan [105] conducted research to evaluate the availability of an educational portal that was based on student preferences for its design features via a questionnaire approach. The students' preferred design features drove a pilot guide in order to assess the use of educational websites.

Universities and/or other academic institutions may consider the order of the design categories in terms of their importance. Şengel and Öncü [5] surveyed the ease of use of a university's site using the website evaluation questionnaire. Usability testing methods can be categorized into an inquiry, inspection, or model/metrics-based, with testing, according to the survey, shown as a convenient technique for collecting users' assessments. The questionnaire consisted of 22 items that sought to find out how the university's website was used by its students, and was applied to a 445 student sample.

Researchers Jabar et al. [106] evaluated the ease of use of university websites. From a total of 351 participants, their study's focus was on measuring the user availability of three university websites. The model for measuring website

availability was based on content organization factors, links and navigation, and the relationship between user interface design and its effectiveness. They described the model as an evaluation guide in order to meet users' needs so as to aid web designers in creating websites with high usability factors.

Astani and Elhindi [22] presented an experimental study of 50 American universities' websites. In today's fiercely competitive marketplace, it is of significant importance that higher education institutions seek out all means of recruiting new students. Therefore, it is important for institutions to evaluate the effectiveness of their websites. The researchers selected the top 50 universities in the United States based on the evaluation of the US News and World Report. The websites were classified by the two experts who conducted investigative research on the design and development of each website. It was reported that the universities needed to update information better on their websites and present it in a layout from which users could more easily locate information of significant importance. The designers were obviously keen that the webpages loaded at speed, with the study's results having showed that the webpages were loaded very quickly. However, the universities needed to improve in the areas of security, customization, usability, and site navigation.

Jabar et al. [102] conducted a study with 364 participants, most of whom were male. Of the participants taken from three universities and colleges, 60.4% were university undergraduate students and 39.6% were graduate students. The feasibility of the university websites were assessed based on five factors of WAMMI: attractiveness, helpfulness, efficiency, controllability, and learnability. Web designers should encourage students to participate in the development of university websites because they are the key users of such academic websites. Designers should also follow guidelines for web development to ensure consistency of design for academic websites. The model should be seen as a tool to attract the attention of website owners and as an important factor to consider when designing educational websites to meet the needs of their core users (students).

Using the same WAMMI method, as well as performance-based evaluation, Roy et al. [20] developed a survey to evaluate the level of usability and accessibility of

three popular academic sites based on human perception. From a total of 68 participants in their usability study, 30 agreed to participate in a performance-based evaluation of three websites. Usability assessment was conducted by analyzing the mission success rate, task completion time, job satisfaction, and results from feedback. The questionnaire-based evaluation results were found to be consistent with the results for performance, performance metrics as task completion time, task success, and number of clicks on the participants' recorded usage sessions using Windows Media Encoder.

Standards of usability can enhance university library websites by considering the university guiding role statement. Stephan et al. [107] reported that usability was led at the University of Mississippi libraries as a major aspect of the progressing appraisal of the libraries and their respective administrations. By setting standards to quantify the achievement of the overview, the researchers were able to evaluate if the libraries' webpages effectively met the objectives and statement of the purpose of the libraries [108].

Online educational interfaces are one type of university web offering that can be adapted to be integrated each semester. Heuristic assessment can be used in order to identify usability issues within online learning applications, and contrast the outcomes of study assessments among the students [109].

2.6.4 Studies Utilizing User Testing

Alexander [110] investigated the experiences of prospective students with 15 university websites (13 from Australia, one from the UK, and one from the US) using three user testing methods (thinking aloud, observation, and questionnaire). In user testing, users are observed whilst performing predetermined tasks related to the website being evaluated [111], [112]. In individual user tests, users are monitored as they perform preassigned tasks in testing a specified website [111], [113]. During the tests, participants are asked to think aloud so that the researcher can record their verbal comments, which is known as Think Aloud Protocol [114], [115]. This method of user testing enables results to be obtained such as the time it takes to complete a certain task, the extent of the user's satisfaction with the website, and the user's success rate for each task. Unlike studies previously mentioned, a study was

conducted on the use of a library website at the Northern Illinois University in the US. In the study, two methodologies were employed, user testing and questionnaire, in an attempt to find the ideal assessment for ease of use and the effectiveness of websites from the perspective of the university's clerks [116].

In a study by Hasan [117], a questionnaire was used in an empirical research with 247 students (155 males, 92 females), with 237 having provided valid responses. The rating was based on a seven-point, Likert-type scale. The study focused on the websites of nine Jordanian universities, and evaluated the employability possibilities in five categories of navigation, engineering/content, communication, usability, and design and organizational content. Although the participants were satisfied with the navigation and content usability of the sites tested, it was shown that the participants were dissatisfied with the design of the websites.

Chaparro [25] focused on the usability assessment of a university's website, using a Windows XP Pentium computer with a 1024 x 768 pixel screen to access the university portal running Sungard's Luminus Platform 3.3.3, in order to record screen events for each task on the site. The participants were photographed using Morae TM 2.0 TechSmith, and a web camera. In addition, Morae TM was used to collect performance data, including the number of pages each participant visited and the time taken on each task. The usability analysis of the university's portal revealed a number of usability issues that affected the end-users' satisfaction.

2.7 University Websites In Libya

Almansuri and Elmansuri [118] mentioned e-learning as being an easy method to utilize ICTs through the Internet. With the help of e-learning, higher education can be conveyed to learners located almost anywhere and they can learn whenever suits them through asynchronous content material. However, the application of e-learning is presenting numerous difficulties for Libyan colleges [119]. The e-adaption of courses ought to meet the National Qualifications Framework (NQF) and Libyan Qualifications Authorities (LQA) requirements. Even though Libyan universities are utilizing certain web services, they still rely on traditional education, preferring face-to-face communication. The utilization of ICTs combined with the implementation of e-learning in Libya is still in its infancy [120]. While some Libyan colleges, for

example, AL Fateh University, Garyounis University, and the Academy of Postgraduate Studies and Economic Research, have the essential ICT framework in place (e.g., personal computers with connected Internet services), they continue to utilize the "conventional" model of training which depends on eye-to-eye classroom connections and learning exercises only accessible within the physical classroom setup [121]. However, the Libyan Open University (LOP) offers undergraduate students the opportunity to study at home.

The advantages of using ICTs in Libyan universities can be observed by exploring institutions such as Misurata University. According to Abod-her [122], the utilization of ICTs in Libyan colleges is based on preferences which were investigated in order to see how ICTs are being utilized within Libyan higher education. Process maps and framework profiling were used to analyze the current day and potential employment of ICTs. In addition, a model for surveying ICT usage within Libyan colleges was developed and applied at Misurata University in northern Libya [120]. An understudy IT manages a wide range of information from new student enrolment right through to their graduation, including a system of study, participation record, instalment of charges and examination results to give just some examples. All of this information should be made accessible through a protected online interface installed within the college website [123].

2.8 Presence of Websites

Assessing large organizations is a significantly difficult task. In order to describe and evaluate establishments such as universities requires the combination of a large number of variables. Webometrics relates to the number and size of electronic publications within a university's webpage. The rating depends on the number of external links that connects webpages to other sites [140]. Web metrics can be defined as the study of all web-related phenomena, the quantitative aspects of building and using information technologies, and the resources that entails on the Internet [140]. Whilst it is difficult to know the relative contribution of each activity in its electronic presence, it can be measured based on its reflection in the overall performance of the institution [141]. Web activity is reflected through the

organization's presence on the web. Therefore, the best way to build classifications is to combine indicators that measure all these different aspects.

Almind and Ingwersen [11] proposed the first Web Impact Factor (WIF) Web index, which is based on correlation analysis that combines the number of website pages and the number of external links as a ratio of 1:1 between visibility and size. This ratio can be used for classification, but with two additional indicators added to the dimension: (a) the number of documents, and (b) the number of publications according to Google Scholar records. Therefore, the European Union's WISER project [36] suggested four indicators as follows:

- **Size (S).** The number of pages retrieved from four engines: Yahoo, Google, Exalead, and Live Search.
- **Visibility (V).** Through, Exalead, Live Search and Yahoo searches, all visible external links received from any site.
- **Rich Files (R).** Adobe PostScript (.ps), Adobe Acrobat (.pdf), Microsoft PowerPoint (.ppt) and Microsoft Word (.doc) are selected based on relevance to publishing activities and academic activities, in addition to considering the size of the different formats.
- **Scholar (Sc).** Google Scholar provides the number of citations and papers for each academic field.

The four ranks are combined based on the these indicators according to the following formula [36], where each has a combined grade and a different weight: Webometrics Rank (position) = 4 * RankV + 2 * RankS + 1 * RankR + 1 * RankSc.

2.9 Previous Studies about University Websites in Libya

Evaluating educational portals is an important issue that requires attention from researchers. However, whilst scientific research on university sites in Libya has been limited, what published evidence is available has been detailed in this section as follows.

According to Othman et al. [123], the use of information and communication technologies (ICTs) has been rapidly expanding in the education sector and

education processes as a whole. Most Libyan higher education institutions (LHEIs) and Libyan universities have attempted to modernize their way of working and tried to make information technology (IT) systems an important element of the education system, Libya's ICT gap was evaluated using the SWOT analysis model, which pointed to key issues of the Libya Higher Education Foundation and key features of online education and learning via questionnaires sent to Libyan students studying in the UK. In addition, the effectiveness of various IT strategies and the many requirements for transitioning from traditional learning to Internet-based were addressed. According to Almansuri and Elmansuri [118], education websites in Libya are considered as an easy program to utilize data and innovative correspondence through utilization of the web. With the help of webpages, higher education can be conveyed to learners anyplace and anytime. Even though the medium of e-Learning has become exceptionally significant to Libyan higher education, it has also met with numerous difficulties in Libyan colleges.

Elzawi et al. [124] examined the attitudes of instructors at a Libyan university towards online learning and training using quantitative and qualitative methods. Five questions were asked of the study's participants, with interview questions created following application of a survey questionnaire. Of the 40 former faculty instructors mailed, only 16 responded to the questions. The result showed a positive attitude toward the integration of Internet-based teaching into the educational process, with expectations that in the coming years it will significantly change the nature of higher education in Libya.

Research by Amaitik and El-Sahli [125] evaluated the usability of the web portal of the Faculty of Information Technology at Benghazi University. In their study, two methods of evaluation were employed, namely the questionnaire-based method and an online method based on tools. The first method was used in order to measure the characteristics of the external portal's content, the information held, the organization of the portal, and its accessibility, links and navigation. The purpose was to focus on evaluating the viability of IT instructors' educational portals from the user's point of view. The second method focused on measuring the interior features of the portal that humans cannot evaluate. The results showed that the portal's usability was found to be at an acceptable level in terms of its quality and performance.

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CHAPTER 3

METHOD

This chapter presents the design of the research, as well as the data collection method, the instrument used in data collection, and the methods employed in the analysis of the collected data. In addition, it provides details about the number and demographics of the participants, the tasks to be carried out by the participants, and the universities selected for the study.

3.1 Research Design

User testing is an important way to identify problems that users experience when using a product or, as in this case, a website [112]. During user testing, users performed specified tasks and were monitored and observed during the exercise [111]. During the tests, users were required to voice aloud their thoughts in order to create a record of their verbal responses, which is known as "Think Aloud Protocol" [114], [115]. From the user's test, performance measures were collected [127]. Questionnaires are considered among the useful tools to collect data in order to obtain user feedback on the usability and to measure user satisfaction of the system [126]. User satisfaction has been accepted as an important indicator for website usability by several studies [127], [20], [128], [129], [130].

In fact, the issue of ease of use and user attendance on the Internet is a large and expanding topic. In the current study, these aspects will be tested through two test methods. The first method is user testing, where participants are monitored and their observations recorded in order to identify issues that users in general may face. In addition, this approach aims to determine the efficiency and effectiveness of the websites. Participants for this method were named as Cohort 1. In the second method, participants were administered a satisfaction survey in order to determine

the participants satisfaction with various aspects of the websites. Participants for this method were named as Cohort 2.

The participants of both cohorts were presented with set tasks to be applied for each of the selected Libyan universities' websites. The relation between the web presence and usability of each academic website is presented as a case study for Libya. Although there have been many studies on the purpose of this research, it is believed that no other studies have been conducted on Libyan universities' websites ease of use, their user attendance, or the interrelations between the websites of Libyan universities.

3.2 Research Questions

The objective of the current study was to find out the relation between usability and Internet presence of Libyan universities. Based on this objective, the following research questions were attempted to be answered, and are set out specific to each cohort:

Cohort 1:
1. Is there any significant difference between Libyan university websites selected and categorized as 1000s, 2000s and 5000sbased on the presence index of webometrics in terms of tasks completion time?
2. Are there any significant interaction effect of the university presence category and age, education level and tasks variables?
3. What are the difficulties faced by the participants of Cohort 1 while using Libyan university websites based on task observation?

Cohort 2:
4. Is there any significant difference between Libyan universities websites presence group and satisfaction results?
5. Is there any significant interaction effect of the university presence category and gender, age, education, Internet usage?

3.3 Participants

The participants were divided into two cohorts. The first cohort consisted of 31 participants and the second consisted of 30 participants. The participants were all Libyan university students from various scientific disciplines who were studying at various higher education levels in the Republic of Turkey at the time of the study. In addition, the participants were selected based on two basic requirements; first, they must possess good computing skills (as users); and second, the participants should not have previously visited any of the selected universities' websites. If any participant reported as having previously visited any of the websites, they were excluded from the study. Table 1 through Table 5 present details of the participants' demographic data.

The age of the participants in Cohort 1 ranged from 20 years old to over 50. The sample was found to be unbalanced in terms of gender as the number of Libyan female students attending higher education studies in Turkey is very low compared to male students. In addition, this may be due to the conservative Libyan Islamic culture; a cultural fact rather than any policy to diminish the prestige of females or to deny their role in society. In Cohort 1, the split between male and female participants was 25 males (80.65%) and six females (19.35%). The participants educational study level in the cohort was more equally balanced, with 16 student participants (51.6%) studying for a Master's degree, and 15 students (48.4%) who were studying for a Doctoral degree.

The age of the participants in Cohort 2 ranged from 20 years old to over 50. The sample for Cohort 2 was similarly unbalanced according to gender for the same reasons as stated for Cohort 1. In Cohort 2, the split between male and female participants was 25 males (83.4%) and five females (16.6%). The participants educational study level in the cohort was found to be seven students (23.4%) studying for a Bachelor's degree, 17 students (56.6%) studying for a Master's degree, and six students (20%) studying for a Doctoral degree.

Table 1 shows the number and percentage split of participants in Cohort 1 by the level of their educational studies. Participants studying for a Master's degree are

represented slightly more than those studying for a doctoral degree. In addition, no participants were studying for a Bachelor's degree in Cohort 1.

	Table 1: Educational Studies of Cohort 1			
N.	Education	Participants	Percent	Cumulative Percent
1	Master's	16	51.6	51.6
2	PhD	15	48.4	100.0
	Total	31	100.0	

Table 2 shows the number and percentage split of participants in Cohort 2 by the level of their educational studies. Participants studying for a Master's degree were greater than for the other levels of study.

	Table 2: Educational Studies of Cohort 2			
	Course	Participants	Percent	Cumulative Percent
1	Bachelor's	7	23.3	23.3
2	Master's	17	56.7	80.0
3	PhD	6	20.0	100.0
	Total	30	100.0	

Table 3 shows the participant age in Cohort 1 as divided into four age groups. Participants between the ages of 30 and 39 years represented over half of the participants in this cohort, whereas participants aged between 20 and 29 years and those aged 50 years or above were the least represented.

	Table 3: Ages of Cohort 1 Participants			
	Age group	Participants	Percent	Cumulative Percent
1	20-29 years	3	9.7	9.7
2	30-39 years	17	54.8	64.5
3	40-49 years	8	25.8	90.3
4	50 years or above	3	9.7	100.0
	Total	31	100.0	

Table 4 shows also the participant age in Cohort 2 as divided into four age groups. Participants between the ages of 30 and 49 are the most represented in this cohort, whereas those aged 50 years or above were the least represented.

Table 4: Ages of Cohort 2 Participants				
	Age group	Participants	Percent	Cumulative Percent
1	20-29 years old	3	10.0	10.0
2	30-39 years old	16	53.7	63.7
3	40-49 years old	9	30.0	93.7
4	50 years or above	2	6.6	100.0
	Total	30	100.0	

Table 5 shows the frequencies for daily Internet usage of participants in Cohort 2, with 80% using the Internet for four or more hours per day.

Table 5: Daily Internet Usage of Cohort 2 Participants			
	Frequency	Percent	Cumulative Percent
Less than four hours	6	20.0	20.0
Four to six hours	14	46.7	66.7
More than six hours	10	33.3	100.0
Total	30	100.0	

3.4 Procedures

This section presents the selection method of the universities upon which this study was conducted, as well as the language of the selected web interfaces, and details of the participants' tasks, the time recording method, as well as details about the participant interviews and the survey questions.

3.4.1 Website Selection Process

The choice of websites was based on the global classification of Webometrics (http://webometrics.info/en). The Webometrics assessment of Universities is the largest system for evaluating international universities, and covers more than 20,000

universities worldwide in a twice annual assessment issued in January and July each year. From the Webometrics website, details can be seen about the international classification of universities in different countries and across the continental groupings (North America, Latin America, Europe, Asia, Africa, Arab countries) [130]. Accordingly, in July 2017, which was at the start of this research, the purpose was to select the top four universities classified under Libya. Unfortunately, the Omar Al Mukhtar University's website was under maintenance at that time, hence the next listed university was chosen according to its ranking. The participants tasks in both cohorts were conducted using the Arabic language interfaces of the selected Libyan university websites.

3.4.1.1 Presence Ranking

Web presence is the collective existence on the Internet of an organization or individual [143]. Web presence is the virtual location on the Internet where a business, person, or an organization are represented, with websites primarily created in order to increase business levels through product offerings as well as information and the facility to make contact [132]. Website presence is a collection of web files about a specific topic that includes a start file called the Home page. For example, most organizations, companies or individuals who have websites operate from a single web address. This is their home page title, from where users can gain access (navigate) to all other pages on the website. For example, the IBM website contains the home page address as http://www.ibm.com. In this case, the actual file name for the home page is not included (which in this case includes "index.html"), but upon entry, the server assumes the full address as being http://www.ibm.com/index.html [144]. An organization's presence on the web can be measured by the business, the number of sites owned, as well as their access, authority to access this domain via popularity, search engine ranking, web traffic, and the number of backlinks to other websites [145]. The presence can also be calculated using the following formula, which is used to calculate a website's Webometrics Rank, or position. The formula is 4 * RankV + 2 * RankS + 1 * RankR + 1 * RankSc [36] .

Table 6 shows which of the Libyan universities were selected, their world ranking, presence ranking, and the websites of each of the universities. The universities were classified according to their presence ranking in three groups, as those below the

presence ranking of 2000 (known as the Presence 1000 group), those at or above the presence ranking of 2000 but below 5000 (known as the Presence 2000 group), and those with a presence ranking at or above 5000 (known as the Presence 5000 group).

Each of the selected websites were assigned to one of the three groups. The Presence 1000 group included the University of Tripoli and the Libyan International Medical University, the Presence 2000 group included Misurata University, and the Presence 5000 group included the University of Benghazi.

Table 6: University Details				
University	World Ranking in the world	Presence Ranking	Website	Group
1 University of Tripoli	4569	1700	http://uot.edu.ly	Presence 1000s group
2 Libyan International Medical University	5414	1080	http://limu.edu.ly	Presence 1000s group
3 Misurata University	5311	2395	http://www.misuratau.edu.ly	Presence 2000s group
4 University of Benghazi	4198	5459	http://www.uob.edu.ly	Presence 5000s group

3.4.2 User Centered Testing

Each participant in the two cohort groups was required to complete five tasks on the Libyan universities' websites. The tasks were selected following a comparison between the four selected websites in order to ascertain the possibility of completing the tasks. A different scenario was created for each participant, for example, each participant starts from a different university than the one initiated by the previous participant, and the same method is performed with tasks in Table 7, which shows the tasks that were selected.

Table 7: Identified Tasks for User Testing	
No.	Task
1	Perform a search for the Department of Pediatric Dentistry in the Faculty of Dental Medicine
2	Find out what courses are offered at the Software Engineering Department within the College of Information Technology
3	Navigate to the Department of Pediatrics within the Faculty of Medicine
4	Find out if the university has a nursing specialty, and whether there are other disciplines offered under it
5	Navigate to the Pharmaceutics Department within the Faculty of Pharmacy

3.4.3 Task Completion – Cohort 1

During the execution of the tasks by the participants in Cohort 1, the time was recorded for each task's completion. A second measurement was taken to assess participant performance so that results would be more appropriate in terms of their accuracy. In order to enable the participants to complete the tasks and so as to obtain a reliable set of results, the same computer with the same the Internet server was used in each test. All of the participants were able to complete all of the assigned tasks on the selected university websites.

3.4.4 Task Completion – Cohort 2

The participants in the second cohort performed the same tasks as those in Cohort 1, but only so far as to obtain information that would enable them to answer the satisfaction survey. Therefore, no time recordings were taken for the participants of Cohort 2. Their primary aim was to learn about the websites of the selected Libyan universities and then to answer the satisfaction survey (see Appendix A).

3.5 Data Collection and Analyses

Prior to carrying out the specified tasks, the aim and objective of the study was clarified to each of the participants, as well as certain instructions pertinent to the operation of the study. The participants of Cohort 1 were also asked to think aloud so that the researcher could record their reactions through observation. The participants randomly completed their assigned tasks for each university so as to ensure that their task differed from the previous participant and also from the next participant. This

approach was taken to ensure that answers were not compared or arranged between the participants. It took a total of 20 days to meet with each of the participants and to collect their responses. The participant data from the two cohorts was then subjected to statistical analysis.

In order to analyze the data collected, the IBM's SPSS statistical analysis program (version 19) was used. The study involved two types of analysis; descriptive analysis, and repeated measures analysis of variance. Firstly, descriptive analysis was performed in order to explain the demographics of the study's participants, which included their gender, age, educational study level, and their daily internet usage. The survey also measured their user satisfaction based on the tasks they were assigned. Secondly, Repeated Measures "Mixed between-within subjects" analysis of variance was performed in order to analyze the results of the satisfaction survey for the participants of Cohort 2. This analysis tested whether or not the interaction between more than one variable was deemed to be significant, and whether or not there were major effects for each of the independent variables [146].

3.6 Instrument

The study employed two methods to obtain data; user testing and satisfaction survey. Each method was applied to one of the two participant cohorts. Cohort 1 applied the five assigned tasks on each of the four selected Libyan universities' websites and recorded their observations. Cohort 2 applied the same five tasks to the same four websites in order to subsequently complete a satisfaction survey to determine their level of user satisfaction, and to establish a measure of the efficiency and effectiveness of the websites without regard to the time factor. The survey questions can be seen as detailed in Appendix A. The survey was divided into two sections:

Demographics: This section consists of four questions and presents an analysis of the demographic characteristics of participants in terms of their gender, age, educational study level, and the number of hours they used the Internet daily.

Satisfaction survey: this section consists of 10 item, five-point, Likert-type scale in order to evaluate the extent of each participants' satisfaction as a user of each website and to assess its effectiveness and efficiency.

This study was based on several previous studies in the method of preparation of the survey. Section one included the demographic data questions based on [134], [135], whilst section two included questions to measure participant satisfaction levels based on [10], [117], [136], [132], [137], [131].

3.7 Validity and Reliability of the Scale

In order to ensure the validity and reliability of the satisfaction survey, a principal components factor analysis was conducted on the 10 items of the scale.

The Kaiser-Meyer-Olkin measure was used to verify the sampling adequacy for the analysis [KMO = .883]. The Bartlett test of Sphericity was used to verify the presence of correlations among the variables, and was found to be significant [χ^2 (45) = 429.040, $p < .001$]. The single factor Presence groups satisfaction scale explained 50.3% of the variance. Table 8 presents the factor loadings after rotation. Considering these results, it can be stated that the scale developed for the current study was deemed to be valid.

Reliability Analysis for the satisfaction survey scale showed that the scale's internal consistency reliability was estimated using Cronbach alpha [$\alpha = .877$]. This result indicates that the scale was found to be of satisfactory reliability.

Table 8 Validity and Reliability of Satisfaction Survey Scale	
	Component
	1
1. I found it difficult remembering how to use the university's website when performing tasks	.348
2. I felt comfortable with the use of the university's website	.791
3. I am satisfied with the usage of the university's website	.840
4. I felt comfortable with the university website's usability	.782
5. I managed to obtain the required information easily	.730
6. I enjoyed using the university's website	.811
7. I am attracted to the university website's design	.617
8. I am satisfied with the results obtained from the university's website	.828
9. I found the university website to be understandable	.484
10. I found the university website to be helpful	.689
Total Explained Variance (%)	**50.300**
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	**.883**
Cronbach's Alpha	**.877**
Bartlett's Test of Sphericity [χ^2 (45) = 429.040, $p < .001$]	
Extraction Method: Principal Component Analysis.	

CHAPTER 4

RESULTS

The statistical analyses performed were descriptive statistics and ANOVA, using IBMs SPSS version 19 statistical software package.

Two groups of participants, known as Cohort 1 and Cohort 2, tested the same presence groups of Libyan university websites. Cohort 1 measured the task completion in terms of time and participant observation (see Figure 2), whereas Cohort 2 measured task completion in terms of participant satisfaction (see Figure 3). Therefore, the two participant cohorts tested the same presence groups. So, repeated
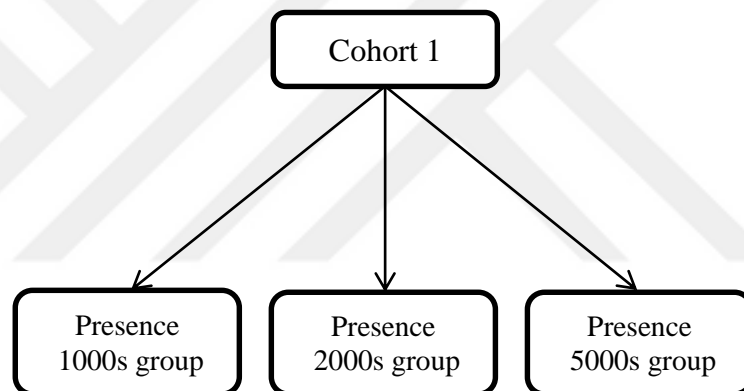
Figure 2: Three different measurements (Task Completion) from the same participants
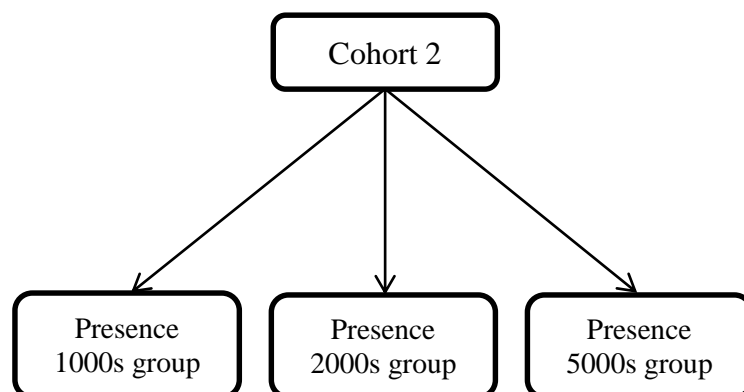
Figure 3: Three different measurements (Satisfaction) from the same participants

measures techniques were used. The repeated measures techniques where the same participants were tested on different occasions or under different conditions. Paired-samples or repeated measures techniques can be used when testing the same item (i.e., websites in this study) on more than one occasion, or you have matched pairs [128].

4.1 Descriptive Statistics Analysis Overview

Data were obtained from a two cohort sample consisting of Cohort 1 with 31 participants and Cohort 2 with 30 participants. The study consisted of a total of 61 respondents who performed five tasks for each of the four selected universities. The descriptive statistics for each of the cohorts are presented as follows.

4.2 Descriptive Results for Cohort 1

Statistical analysis in Cohort 1 was based on time as the key measurement factor. The participants took between 8 and 480 seconds to complete each of the assigned tasks.

4.2.1 Mixed Between-Within Subjects' Analysis of Variance

Mixed between-within subjects' analysis of variance (ANOVA) was used in order to test the task difficulty differential between the demographic factors of the presence groups. Additionally, the test evaluated the change in task difficulty scores (time measured in seconds) across the three presence groups.

The ANOVA analysis of variance was conducted to assess the impact of the participants age, educational study level, and the individual assigned tasks on the participants' time scores across all three groups (Presence 1000 group, Presence 2000 group, and Presence 5000 group). Table 9 shows that a statistically significant effect was found for the presence groups [Wilks' Lambda = .561, $F(2, 129) = 50.427$, $p < .001$, partial eta squared = .439], which explained 43.9% of the total variance. There was significant interaction effect found between the presence groups and the tasks [Wilks' Lambda = .157, $F(8, 258) = 49.079$, $p < .001$, partial eta squared = .603], which explained 60.3% of the total variance.

Table 9: Multivariate Tests Between-Within Subjects in Cohort 1							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Presence groups	Pillai's Trace	.439	50.427[b]	2.000	129.000	.000	.439
	Wilks' Lambda	.561	50.427[b]	2.000	129.000	.000	.439
	Hotelling's Trace	.782	50.427[b]	2.000	129.000	.000	.439
	Roy's Largest Root	.782	50.427 [b]	2.000	129.000	.000	.439
Presence groups * Age	Pillai's Trace	.019	.623	4.000	260.000	.647	.009
	Wilks' Lambda	.981	.621 [b]	4.000	258.000	.648	.010
	Hotelling's Trace	.019	.619	4.000	256.000	.649	.010
	Roy's Largest Root	.019	1.249 [C]	2.000	130.000	.290	.019
Presence groups * Education	Pillai's Trace	.020	1.284 [b]	2.000	129.000	.280	.020
	Wilks' Lambda	.980	1.284 [b]	2.000	129.000	.280	.020
	Hotelling's Trace	.020	1.284 [b]	2.000	129.000	.280	.020
	Roy's Largest Root	.020	1.284 [b]	2.000	129.000	.280	.020
Presence groups * Tasks	Pillai's Trace	.974	30.827	8.000	260.000	.000	.487
	Wilks' Lambda	.157	49.079 [b]	8.000	258.000	.000	.603
	Hotelling's Trace	4.528	72.442	8.000	256.000	.000	.694
	Roy's Largest Root	4.336	140.913 [C]	4.000	130.000	.000	.813
Presence groups * Age * Education	Pillai's Trace	.001	.096 [b]	2.000	129.000	.909	.001
	Wilks' Lambda	.999	.096 [b]	2.000	129.000	.909	.001
	Hotelling's Trace	.001	.096 [b]	2.000	129.000	.909	.001
	Roy's Largest Root	.001	.096 [b]	2.000	129.000	.909	.001
Presence groups * Age * Tasks	Pillai's Trace	.062	.519	16.000	260.000	.937	.031
	Wilks' Lambda	.939	.517 [b]	16.000	258.000	.937	.031

Effect	Statistic	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
	Hotelling's Trace	.064	.515	16.000	256.000	.938	.031
	Roy's Largest Root	.049	.796 [c]	8.000	130.000	.607	.047
Presence groups * Education * Tasks	Pillai's Trace	.037	.607	8.000	260.000	.771	.018
	Wilks' Lambda	.963	.608 [b]	8.000	258.000	.771	.018
	Hotelling's Trace	.038	.608	8.000	256.000	.771	.019
	Roy's Largest Root	.036	1.180 [c]	4.000	130.000	.323	.035
Presence groups * Age * Education * Tasks	Pillai's Trace	.008	.126	8.000	260.000	.998	.004
	Wilks' Lambda	.992	.125 [b]	8.000	258.000	.998	.004
	Hotelling's Trace	.008	.124	8.000	256.000	.998	.004
	Roy's Largest Root	.005	.173 [c]	4.000	130.000	.952	.005

a. Design: Intercept + Age + Education + Tasks + Age * Education + Age * Tasks + Education * Tasks + Age * Education * Tasks
 Within Subjects Design: Presence groups

b. Exact statistic

c. The statistic is an upper bound on *F* that yields a lower bound on the significance level.

Table 10 shows the estimates of mean time (in seconds). The Presence 2000 group displayed the lowest mean time ($M = 39.477$), while the Presence 5000 group displayed the highest mean time ($M = 78.679$).

Table 10: Mean Time Estimates of Presence Groups – Cohort 1				
Measure: Time (seconds)				
Presence groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Presence 1000s group	42.497 [a]	2.075	38.391	46.602
Presence 2000s group	39.477 [a]	2.182	35.161	43.793
Presence 5000s group	78.679 [a]	3.509	71.737	85.621
a. Based on modified population marginal mean				

4.2.2 Interaction Effect Between Tasks and Websites

Table 11 shows the mean values for the tasks in each presence group. The highest mean time (243.69 seconds) was recorded for Task 5 (Navigate to the Pharmaceutics Department within the Faculty of Pharmacy) on the Presence 5000 group. The lowest mean time (18.73 seconds) was recorded for the same task (Task 5) on the Presence 2000 group.

Table 11: Interaction Effect between Tasks and Presence Groups – Cohort 1						
Measure: Time (seconds)						
Task	Presence Group	Mean	Std. Error	95% Confidence Interval		Total task mean
				Lower Bound	Upper Bound	
Perform a search for the Department of Pediatric Dentistry in the Faculty of Dental Medicine	Presence 1000s group	44.628[a]	4.640	35.448	53.808	37.040
	Presence 2000s group	27.994[a]	4.878	18.343	37.645	
	Presence 5000s group	38.498[a]	7.846	22.976	54.020	
Find out what courses are offered at the Software Engineering Department within the College of Information Technology	Presence 1000s group	57.388[a]	4.640	48.208	66.568	61.391
	Presence 2000s group	72.448[a]	4.878	62.797	82.098	
	Presence 5000s group	54.338[a]	7.846	38.816	69.860	
Navigate to the Department of Pediatrics within the Faculty of Medicine	Presence 1000s group	27.732[a]	4.640	18.552	36.912	35.519
	Presence 2000s group	47.551[a]	4.878	37.900	57.202	
	Presence 5000s group	31.274[a]	7.846	15.752	46.796	

Table 11: Interaction Effect between Tasks and Presence Groups – Cohort 1						
Measure: Time (seconds)						
Task	Presence Group	Mean	Std. Error	95% Confidence Interval		Total task mean
				Lower Bound	Upper Bound	
Find out if the university has a nursing specialty, and whether there are other disciplines offered under it	Presence 1000s group	41.524[a]	4.640	32.344	50.704	32.595
	Presence 2000s group	30.663[a]	4.878	21.012	40.314	
	Presence 5000s group	25.597[a]	7.846	10.075	41.119	
Navigate to the Pharmaceutics Department within the Faculty of Pharmacy	Presence 1000s group	41.212[a]	4.640	32.032	50.392	101.209
	Presence 2000s group	18.727[a]	4.878	9.076	28.378	
	Presence 5000s group	243.688[a]	7.846	228.166	259.210	
a. Based on modified population marginal mean.						

4.2.3 Tests of Within-Subjects Contrasts

Table 12 shows tests of Within-Subjects Contrasts. There was a statistically significant mean difference found between the Presence 5000 group and the two other two presence groups $[F (1, 130) = 101.510$, $p < .001$, partial eta squared = .438], which explained 43.8% of the total variance. There was significant interaction between tasks and groups in the Presence 2000 group compared to the Presence 1000 group $[F (4, 130) = 9.675$, $p < .001$, partial eta squared = .229], which explained 22.9% of the total variance. Also, there was a significant interaction found between tasks and presence groups in the Presence 5000 group compared to the two other presence groups $[F (4, 130) = 140.911$, $p < .001$, partial eta squared = .813], which explained 81.3% of the total variance.

Table 12: Within-Subjects Contrasts Between Presence Groups – Cohort 1							
Measure: Time (seconds)							
Source	Presence groups	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Groups	Presence 2000s group vs. Presence 1000s group	1363.873	1	1363.873	1.669	.199	.013
	Presence 5000s group vs. Previous	142342.341	1	142342.341	101.510	.000	.438
Groups * Tasks	Presence 2000s group vs. Presence 1000s group	31618.497	4	7904.624	9.675	.000	.229
	Presence 5000s group vs. Previous	790368.769	4	197592.192	140.911	.000	.813

Table 13 shows paired samples *t*-test statistics of Pair 3. The highest mean recorded value was for the Presence 5000 group [*M* = 78.77, *SD* = 88.202)], whilst the lowest mean recorded value was for the Presence 2000 group [*M* = 39.63, *SD* = 27.810].

Table 13: Paired Samples Statistics Between Presence Groups – Cohort 1					
		Mean	N	*Std. Deviation*	Std. Error Mean
Pair 1	Presence 1000s group	43.9323	31	23.50684	1.88812
	Presence 2000s group	39.63	31	27.810	2.234
Pair 2	Presence 1000s group	43.9323	31	23.50684	1.88812
	Presence 5000s group	78.77	31	88.202	7.085
Pair 3	Presence 2000s group	39.63	31	27.810	2.234
	Presence 5000s group	78.77	31	88.202	7.085

Table 14 shows paired samples correlations between the three pairs. There were two significant correlations found; between the Presence 1000 group and the Presence 2000 group [*r* = .260, *p* = .001], and between the Presence 2000 group and the Presence 5000 group [*r* = -.258, *p* = .001], although this correlation could be said to be very weak.

Table 14: Paired Samples Correlations Between Presence Groups – Cohort 1		*N*	Correlation	Sig.
Pair 1	Presence 1000s group & Presence 2000s group	31	.260	.001
Pair 2	Presence 1000s group & Presence 5000s group	31	.056	.488
Pair 3	Presence 2000s group & Presence 5000s group	31	-.258-	.001

Table 15 provides the results of a paired-samples *t*-test that was conducted to evaluate task difficulty in the three presence groups. There was a marginal decrease in time from the Presence 1000 group [*M* = 43.93, *SD* = 23.51] to the Presence 2000 group [*M* = 39.63, *SD* = 27.81, t (154) = 1.708, p = .09 (two-tailed)]. The mean difference in time scores was 4.31, with a 95% confidence interval ranging from -.67534 to 9.28825. The eta squared statistic (.02) indicated a small effect size.

There was a statistically significant increase in time from the Presence 1000 group [*M* = 43.93, *SD* = 23.51] to the Presence 2000 group [*M* = 78.77, *SD* = 88.20, t (154) = -4.819, p < .001 (two-tailed)]. The mean difference in time scores was 34.835, with a 95% confidence interval ranging from -49.11578 to -20.55519. The eta squared statistic (.13) indicated a moderate effect size.

There was a statistically significant increase in time from the Presence 2000 group [*M* = 39.63, *SD* = 27.81] to the Presence 5000 group [*M* = 78.77, *SD* = 88.20, t (154) = -4.819, p < .001 (two-tailed)]. The mean difference in time scores was 39.142, with a 95% confidence interval ranging from -54.867 to -23.417. The eta squared statistic (.14) indicated a large effect size.

Table 15: Paired Samples Test Between Presence Groups – Cohort 1								
Presence Groups	Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2-tl)
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 — Presence 1000s group - Presence 2000s group	4.30645	31.39621	2.52180	-.67534-	9.28825	1.708	154	.090
Pair 2 — Presence 1000s group- Presence 5000s group	-34.83548-	89.99713	7.22874	-49.11578-	-20.55519-	-4.819-	154	.000
Pair 3 — Presence 2000s group- Presence 5000s group	-39.142-	99.101	7.960	-54.867	-23.417	-4.917	154	.000

4.2.4 Analysis of Observation of Cohort 1

The following results were created based on the views and reactions of the participants. These views were provided by the participants and represent constructive criticism of the weaker points of the universities' websites. The websites of the selected Libyan universities were found to have many problems, related to design and usability, which agreed and differed between the universities. These problems are summarized as follows; with the numbers of participants who observed similar problems presented in Table 16.

Here it would be illogical to continue to integrate universities into presence groups where the participants' observations were recorded based on the differences in design and content of each of the universities' websites. In addition, the comments differed for the same participant from one website to another.

The observations were analyzed descriptively, where the numbers of similar observations were combined for each university. When performing tasks, the participants in Cohort 1 were asked to think aloud in order for the researcher to

record the feedback from each of the participants. The flowchart presented as Figure 3 depicts the process of recording observations and recording the time taken for the completion of the tasks.
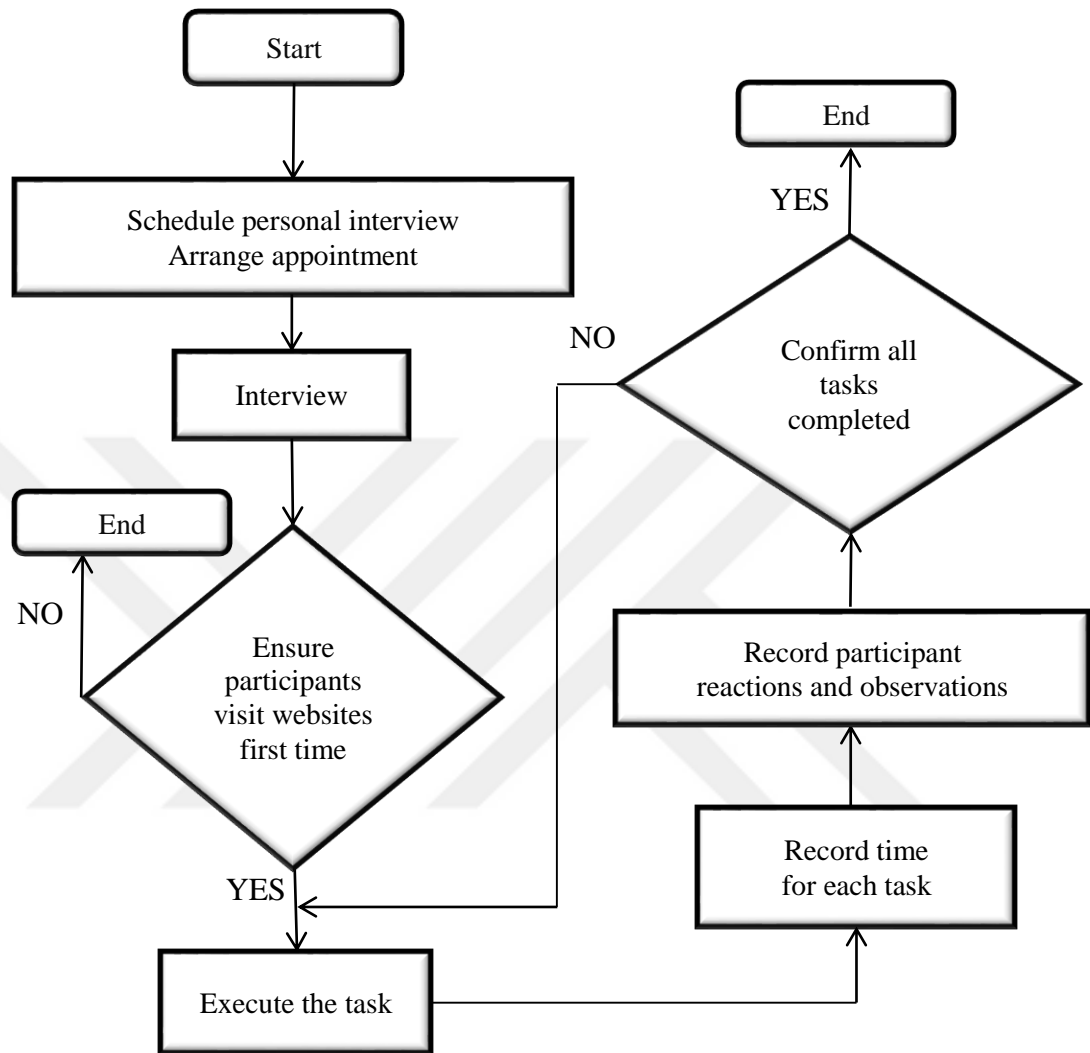
Figure 4: Recording Observations and Task Completion Times

Table 16: Observations of Participants – Cohort 1				
OBSERVATIONS / UNIVERSITY	University of Tripoli Presence 1000s group	Libyan International Medical University Presence 1000s group	University of Benghazi Presence 5000s group	Misurata University Presence 2000s group
1. 1. Inability to return to the homepage directly "There is no button or phrase showing how to go back to the home page."	2	3	29	18
2. Overlap in faculties information.	3	4	20	2
3. Search box was not working correctly.	15	28	18	22
4. Incomplete data for faculty members.	20	18	28	12
5. Address bar when logging in did not change; keeps address bar the same as the home page.	3	29	2	23
6. Some necessary information could not be viewed directly (located at base of page).	19	30	4	28
7. No hyperlink to departments.	24	27	19	28
8. Weak process for updating information and data.	20	31	23	2
9. Colors used when placing the cursor over options in main menu annoying to the eye.	27	2	4	5
10. Color and size of font unsuitable, leading to difficulties in reading.	29	27	3	25
11. Faculty departments do not have own pages, only textual data.	3	26	4	24
12. University website easy to use.	22	2	2	3
13. University website difficult to use.	4	27	9	5

4.2.5 Testing Frequency Distribution Across Categories of Websites

Table 17 shows the hypothesis test summary of frequency distributions across the website categories.

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Table 17: Hypothesis Test Summary of Websites – Cohort 1				
	Null Hypothesis	Test	Sig.	Decision
1	Distribution of frequencies is the same across website categories	Independent samples Kruskal-Wallis Test	.417	Retain the null hypothesis

A Kruskal-Wallis Test (see Table 18) revealed no statistically significant difference in observations' frequencies across the four selected Libyan university websites (University of Benghazi " Presence 5000s group", University of Tripoli " Presence 1000s group" , Misurata University "Presence 2000s group" and Libyan International Medical University " Presence 1000s group"), $[\chi^2 (3, n = 52) = 2.842, p = .417]$.

Table 18: Test Statistics of Websites – Cohort 1	
	Frequencies
Chi-Square	2.842
df	3
Asymp. Sig.	.417
a. Kruskal Wallis Test	
b. Grouping Variable: Websites	

4.2.6 Testing Frequency Distributions Across Categories of Observations

Table 19 shows the hypothesis test summary of frequency distributions across the observation categories.

Table 19: Hypothesis Test Summary of Observations – Cohort 1				
	Null Hypothesis	Test	Sig.	Decision
1	Distribution of frequencies is the same across observation categories	Independent samples Kruskal-Wallis Test	.414	Retain the null hypothesis

A Kruskal-Wallis Test (see Table 20) revealed no statistically significant difference in observations' frequencies across the 13 observations (OB1 to OB13) $[\chi^2 (12, n = 52) = 12.404, p = .414]$.

Table 20: Test Statistics of Observations – Cohort 1	
	Frequencies
Chi-Square	12.404
df	12
Asymp. Sig.	.414
a. Kruskal Wallis Test	
b. Grouping Variable: Observations	

4.3 Descriptive Results for Cohort 2

The statistical analysis for Cohort 2 is based on data from the completed satisfaction surveys.

4.3.1 Descriptive Results for Satisfaction Scale and Scale Items

Table 21 presents the descriptive statistics for the satisfaction scale. The Presence 5000 group recorded the highest mean value in the five-point, Likert-type scale [$M = 2.72$, $SD = .68213$], whereas the Presence 1000 group recorded the lowest mean value [$M = 2.44$, $SD = .60628$].

For scale item Q7 ("I am attracted to the university website's design"), the Presence 5000 group recorded the highest mean value [$M = 3.10$, $SD = 1.155$], while for Q8 ("I am satisfied with the results obtained from the university's website"), the Presence 2000 group recorded the lowest mean value [$M = 2.10$, $SD = .923$].

Table 21: Descriptive Statistics for Satisfaction survey – Cohort 2	N	Mean	Std. Deviation
Presence 1000s Group	30	2.44	.60628
1. I found it difficult remembering how to use the university's website when performing tasks	30	2.47	.840
2. I felt comfortable with the use of the university's website	30	2.37	.730
3. I am satisfied with the usage of the university's website	30	2.27	.796
4. I felt comfortable with the university website's usability	30	2.40	.781
5. I managed to obtain the required information easily	30	2.38	.878

Table 21: Descriptive Statistics for Satisfaction survey – Cohort 2	N	Mean	Std. Deviation
6. I enjoyed using the university's website	30	2.32	.713
7. I am attracted to the university website's design	30	2.52	.825
8. I am satisfied with the results obtained from the university's website	30	2.32	.866
9. I found the university website to be understandable	30	2.73	.868
10. I found the university website to be helpful	30	2.60	.792
Presence 2000s Group	**30**	**2.45**	**.67657**
1. I found it difficult remembering how to use the university's website when performing tasks	30	2.73	1.143
2. I felt comfortable with the use of the university's website	30	2.57	1.135
3. I am satisfied with the usage of the university's website	30	2.23	.858
4. I felt comfortable with the university website's usability	30	2.47	.900
5. I managed to obtain the required information easily	30	2.30	1.022
6. I enjoyed using the university's website	30	2.53	1.137
7. I am attracted to the university website's design	30	2.53	1.252
8. I am satisfied with the results obtained from the university's website	30	2.10	.923
9. I found the university website to be understandable	30	2.63	.890
10. I found the university website to be helpful	30	2.43	.898
Presence 5000s Group	30	2.72	.68213
1. I found it difficult remembering how to use the university's website when performing tasks	30	2.50	1.137
2. I felt comfortable with the use of the university's website	30	2.70	.837
3. I am satisfied with the usage of the university's website	30	2.73	1.081
4. I felt comfortable with the university website's usability	30	2.80	1.064
5. I managed to obtain the required information easily	30	2.60	.894
6. I enjoyed using the university's website	30	2.90	.885
7. I am attracted to the university website's design	30	3.10	1.155

Table 21: Descriptive Statistics for Satisfaction survey – Cohort 2			
	N	Mean	Std. Deviation
8. I am satisfied with the results obtained from the university's website	30	2.47	1.042
9. I found the university website to be understandable	30	2.63	1.033
10. I found the university website to be helpful	30	2.80	.961
Valid N (listwise)	30		

4.3.2 Mixed Between-Within Subjects' Analysis of Variance

Mixed between-within subjects' analysis of variance was used in order to test satisfaction differences between the demographic factors of the presence groups, and changes in participants' satisfaction scores across the three presence groups.

Table 22 provides the results of a mixed between-within subjects' analysis of variance that was conducted to assess the impact of the variables of Gender, Age, Education study level, and Usage of Internet on the participants' satisfaction scores across the three presence groups.

There was a marginal main effect seen for the presence groups [Wilks' Lambda = .551, $F(2, 9) = 3.670$, $p = .068$, partial eta squared = .449], which explained 44.9% of the total variance. There was significant interaction seen between Usage of Internet and Satisfaction for the presence groups [Wilks' Lambda = .364, $F(4, 18) = 2.955$, $p = .049$, partial eta squared = .396], which explained 39.6% of the total variance.

Table 22: Multivariate Tests Between-Within Subjects – Cohort 2							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Presence groups	Pillai's Trace	.449	3.670[b]	2.000	9.000	.068	.449
	Wilks' Lambda	.551	3.670[b]	2.000	9.000	.068	.449
	Hotelling's Trace	.816	3.670[b]	2.000	9.000	.068	.449
	Roy's Largest Root	.816	3.670[b]	2.000	9.000	.068	.449
presence groups * Gender	Pillai's Trace	.140	.730[b]	2.000	9.000	.508	.140
	Wilks' Lambda	.860	.730[b]	2.000	9.000	.508	.140
	Hotelling's Trace	.162	.730[b]	2.000	9.000	.508	.140
	Roy's Largest Root	.162	.730[b]	2.000	9.000	.508	.140

Table 22: Multivariate Tests Between-Within Subjects – Cohort 2							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Presence groups * Aga	Pillai's Trace	.240	.682	4.000	20.000	.612	.120
	Wilks' Lambda	.774	.616[b]	4.000	18.000	.657	.120
	Hotelling's Trace	.275	.549	4.000	16.000	.702	.121
	Roy's Largest Root	.169	.847[c]	2.000	10.000	.457	.145
presence groups * Education	Pillai's Trace	.134	.360	4.000	20.000	.834	.067
	Wilks' Lambda	.866	.336[b]	4.000	18.000	.850	.069
	Hotelling's Trace	.155	.310	4.000	16.000	.867	.072
	Roy's Largest Root	.154	.770[c]	2.000	10.000	.489	.133
presence groups * Usage of Internet	Pillai's Trace	.636	2.330	4.000	20.000	.091	.318
	Wilks' Lambda	.364	2.955[b]	4.000	18.000	<mark>.049</mark>	.396
	Hotelling's Trace	1.745	3.489	4.000	16.000	.031	.466
	Roy's Largest Root	1.745	8.723[c]	2.000	10.000	.006	.636
presence groups * Gender * Age	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	9.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	2.000	8.000	1.000	.000
presence groups * Gender * Education	Pillai's Trace	.096	.481[b]	2.000	9.000	.633	.096
	Wilks' Lambda	.904	.481[b]	2.000	9.000	.633	.096
	Hotelling's Trace	.107	.481[b]	2.000	9.000	.633	.096
	Roy's Largest Root	.107	.481[b]	2.000	9.000	.633	.096
presence groups * Gender * Usage of Internet	Pillai's Trace	.180	.991[b]	2.000	9.000	.408	.180
	Wilks' Lambda	.820	.991[b]	2.000	9.000	.408	.180
	Hotelling's Trace	.220	.991[b]	2.000	9.000	.408	.180
	Roy's Largest Root	.220	.991[b]	2.000	9.000	.408	.180
presence groups * Age * Education	Pillai's Trace	.283	.824	4.000	20.000	.525	.142
	Wilks' Lambda	.730	.767[b]	4.000	18.000	.561	.146
	Hotelling's Trace	.352	.704	4.000	16.000	.601	.150
	Roy's Largest Root	.290	1.450[c]	2.000	10.000	.280	.225
presence groups * Age * Usage of Internet	Pillai's Trace	.216	.606	4.000	20.000	.663	.108
	Wilks' Lambda	.788	.569[b]	4.000	18.000	.689	.112
	Hotelling's Trace	.263	.526	4.000	16.000	.718	.116
	Roy's Largest Root	.239	1.197[c]	2.000	10.000	.342	.193
presence groups * Education * Usage of Internet	Pillai's Trace	.378	.582	8.000	20.000	.781	.189
	Wilks' Lambda	.648	.545[b]	8.000	18.000	.808	.195
	Hotelling's Trace	.504	.504	8.000	16.000	.836	.201
	Roy's Largest Root	.406	1.014[c]	4.000	10.000	.445	.289
Groups * Gender *	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	9.500	.	.

Table 22: Multivariate Tests Between-Within Subjects – Cohort 2							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Age * Education	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	2.000	8.000	1.000	.000
Presence groups * Gender * Age * Usage of Internet	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	9.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	2.000	8.000	1.000	.000
Presence groups * Gender * Education * Usage of Internet	Pillai's Trace	.202	1.141[b]	2.000	9.000	.362	.202
	Wilks' Lambda	.798	1.141[b]	2.000	9.000	.362	.202
	Hotelling's Trace	.254	1.141[b]	2.000	9.000	.362	.202
	Roy's Largest Root	.254	1.141[b]	2.000	9.000	.362	.202
Presence groups * Age * Education * Usage of Internet	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	9.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	2.000	8.000	1.000	.000
Presence groups * Gender * Age * Education * Usage of Internet	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	9.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	2.000	8.000	1.000	.000
a. Design: Intercept + Gender + Age + Education + Usage of Internet + Gender * Age + Gender * Education + Gender * Usage of Internet + Age * Education + Age * Usage of Internet + Education * Usage of Internet + Gender * Age * Education + Gender * Age * Usage of Internet + Gender * Education * Usage of Internet + Age * Education * Usage of Internet + Gender * Age * Education * Usage of Internet Within Subjects Design: presence groups							
b. Exact statistic							
c. Statistic is an upper bound on *F* that yields a lower bound on the significance level							

Table 23 shows estimates of the mean satisfaction levels across the presence groups in the five-point, Likert-type scale. The Presence 5000 group scored the highest mean value [$M = 2.768$], while the Presence 1000 group scored the lowest mean value [$M = 2.396$].

Table 23: Estimate Mean Satisfaction Across Presence Groups – Cohort 2				
Measure: Satisfaction				
Presence group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Presence 1000s group	2.396[a]	.155	2.051	2.740
Presence 2000s group	2.413[a]	.166	2.043	2.782
Presence 5000s group	2.768[a]	.136	2.465	3.071
a. Based on modified population marginal mean				

Table 24 shows estimates of the mean satisfaction interaction effect between Usage of Internet and the presence groups in the five-point, Likert-type scale. The Usage of Internet for Cohort 2 (six hours or more) in the Presence 5000 group displayed the highest mean value [$M = 3.254$], whereas the same group displayed the lowest mean value [$M = 2.179$] for the Presence 2000 group.

Table 24: Interaction Effect Between Usage of Internet and Presence Groups – Cohort 2						
Measure: Satisfaction						
Usage of Internet	Presence groups	Mean	Std. Error	95% Confidence Interval		Usage groups' mean
				Lower Bound	Upper Bound	
Less than 4 hours	Presence 1000s group	2.754[a]	.340	1.998	3.511	2.851
	Presence 2000s group	2.825[a]	.364	2.013	3.637	
	Presence 5000s group	2.975[a]	.299	2.309	3.641	
Between 4 and 6 hours	Presence 1000s group	2.368[a]	.229	1.857	2.879	2.359
	Presence 2000s group	2.411[a]	.246	1.863	2.959	
	Presence 5000s group	2.299[a]	.202	1.849	2.749	
6 hours or more	Presence 1000s group	2.227[a]	.266	1.635	2.819	2.553
	Presence 2000s group	2.179[a]	.285	1.543	2.814	
	Presence 5000s group	3.254[a]	.234	2.733	3.774	
a. Based on modified population marginal mean						

Table 25 shows pairwise comparisons with Adjustment for multiple comparisons: Bonferroni. There was a statistically significant difference seen for Group

satisfaction between the Presence 1000 group and the Presence 5000 group [mean difference = -.373, *p* = .031]. Also, there was a statistically marginal difference on the presence groups satisfaction between the Presence 2000 group and the Presence 5000 group [mean difference = -.356, *p* = .051].

Table 25: Pairwise Comparisons with Adjustment for Multiple Comparisons – Cohort 2						
Measure: Satisfaction						
(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig. [c]	95% Confidence Interval Difference	
					Lower Bound	Upper Bound
Presence 1000s group	Presence 2000s group	-.017[a]	.113	1.000	-.340	.307
	Presence 5000s group	-.373[a,*]	.118	.031	-.712	-.033
Presence 2000s group	Presence 1000s group	.017[a]	.113	1.000	-.307	.340
	Presence 5000s group	-.356[a]	.124	.051	-.713	.001
Presence 5000s group	Presence 1000s group	.373[a,*]	.118	.031	.033	.712
	Presence 2000s group	.356[a]	.124	.051	-.001	.713
Based on estimated marginal means						
*. The mean difference is significant at the .05 level						
a. Based on modified population marginal mean						
c. Adjustment for multiple comparisons: Bonferroni						

Table 26 shows paired samples *t*-test statistics of the three pairs of presence groups. The highest mean value was recorded for the Presence 5000 group [*M* = 2.72, *SD* = .68], whilst the lowest mean value was recorded for the Presence 1000 group [*M* = 2.44, *SD* = .61].

Table 26: Paired Samples Statistics Between Presence Groups – Cohort 2		Mean	*N*	*Std. Deviation*	Std. Error Mean
Pair 1	Presence 1000s group	2.4367	30	.60628	.11069
	Presence 2000s group	2.4533	30	.67657	.12352
Pair 2	Presence 1000s group	2.4367	30	.60628	.11069
	Presence 5000s group	2.7233	30	.68213	.12454
Pair 3	Presence 2000s group	2.4533	30	.67657	.12352
	Presence 5000s group	2.7233	30	.68213	.12454

Table 27 shows paired samples correlations between the three pairs of presence groups. All of the pairs were found to have significant correlations; between Presence 1000 group and Presence 2000 group [$r = .652$, $p < .001$], between Presence 1000 group and Presence 5000 group [$r = .463$, $p = .010$], and between Presence 2000 group and Presence 5000 group [$r = .415$, $p = .023$].

Table 27: Paired Samples Correlations Between Presence Groups – Cohort 2		*N*	Correlation	Sig.
Pair 1	Presence 1000s group & Presence 2000s group	30	.652	.000
Pair 2	Presence 1000s group & Presence 5000s group	30	.463	.010
Pair 3	Presence 2000s group & Presence 5000s group	30	.415	.023

Table 28 provides the results of a paired-samples *t*-test conducted in order to evaluate participant satisfaction with the three presence groups of websites. There was no statistically significant difference found for Satisfaction between the Presence 1000 group [$M = 2.44$, $SD = .61$] and the Presence 2000 group [$M = 2.45$, $SD = .68$, $t (29) = -.169$, $p = .867$ (two-tailed)].

There was a statistically significant increase found for Time from the Presence 1000 group [$M = 2.44$, $SD = .61$] to the Presence 5000 group [$M = 2.72$, $SD = .68$, $t (29) = -2.012$, $p = .054$ (two-tailed)]. The mean difference in time scores was .29, with a 95% confidence interval ranging from -.53710 to -.03623. The eta squared statistic (.16) indicated a large effect size.

There was a statistically significant increase found for Time from the Presence 2000 group [$M = 2.45$, $SD = .68$] to the Presence 5000 group [$M = 2.72$, $SD = .68$, $t(29) = -4.819$, $p < .001$ (two-tailed)]. The mean difference in time scores was .27, with a 95% confidence interval ranging from -.54442 to -.00442. The eta squared statistic (.12) indicated a moderate effect size.

Table 28: Paired Samples Test Between Presence Groups – Cohort 2								
Presence Groups		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference				
					Lower	Upper			
Pair 1	Presence 1000s group - Presence 2000s group	-.01667-	.53889	.09839	-.21789-	.18456	-.169-	29	.867
Pair 2	Presence 1000s group - Presence 5000s group	-.28667-	.67068	.12245	-.53710-	-.03623-	-2.341-	29	.026
Pair 3	Presence 2000s group - Presence 5000s group	-.27000-	.73492	.13418	-.54442-	.00442	-2.012-	29	.054

CHAPTER 5

DISCUSSION

Usability and presence of websites are essential factors to consider for any organization. Measuring the impact of the internet has become a significant topic of study among researchers [72]. The current study concerned the evaluating of this issue with regard to the websites of Libyan universities. This study evaluated websites from three important perspectives: efficiency, effectiveness, and user satisfaction. The results of the data collected from the participants in the current study, according to their distribution that was explained in Chapter III on Method, were achieved from conducting different tests for each cohort group in order to obtain the desired results. The aim of the study was to address a known gap in the literature due to a lack of research evaluating the usability of Arabic language university websites [105].

The current study's results included observations of the participants of Cohort 1 that the websites of Libyan universities suffer from many common usage problems such as using inappropriate font sizes, text colors, and poor coordination between the main website menu and webpage hyperlinks. In addition to the presence of certain information being inappropriately located, these results indicate poor levels of usability of the evaluated websites. These results are consistent with those of Bairamzadeh and Bolhari [137], where lack of clarity of the basic webpage concepts and the absence of navigational aids negatively impact on the usability of such websites. Also, the study of Gullikson et al. [138] found poor labeling of concepts, the lack of navigational aids, and the poor organization of information to clearly impact on the usability of the examined websites.

In the current study, analysis of variance revealed a statistical association between all three of the presence groups, as well as a difference in the difficulty of tasks in view of the time taken to complete those tasks. This reflects weakness in the websites tested of Libyan universities in terms of their efficiency and effectiveness. Table 10 shows that the highest mean number in the Presence 5000 group was due to the

difficulty of completing Task 5 (Navigate to the Pharmaceutics Department within the Faculty of Pharmacy) on the website of the University of Benghazi, which was referred to as the Presence 5000 group. The results showed that the task took longer to complete than other tasks. Also, this was inferred in Table 11, where Task 5 recorded the highest mean value based on the interaction effect between tasks and presence groups.

The current study found when testing internal contradictions, that a statistically significant difference was found between the Presence 5000 group and the two other presence groups due to the difficulties that participants experienced in performing Task 5 (Navigate to the Pharmaceutics Department within the Faculty of Pharmacy) in the Presence 5000 group. There was also a statistically significant interaction found between Tasks and the Presence 1000 group and also with the Presence 2000 group due to the convergence of task completion times for these presence groups. A significant statistical interaction was also found between Tasks and the Presence 5000 group when compared with the two other presence groups. The reason for this statistical significance is due to the poor design and non-classification of data on the websites of the evaluated Libyan universities, according to the participants' observations. This had a negative effect on the effectiveness of the websites. In order to improve the effectiveness of such websites, administrators should demand that their organizations acquire or develop and maintain well-designed websites [139].

In the study of Peker et al. [127], the participants were found to be satisfied with the websites of the universities they inspected. In addition, whilst the universities evaluated were found to have a strong presence, the study also found that universities can increase their web presence on the Internet by increasing interest in the issue of their websites' ease of use factor; as, due to difficulties of certain tasks, the time allotted for the execution of tasks for some of the participants was too short, rendering them unable to complete their tasks. In a research study on Jordanian universities, Hasan [117] reported that students were satisfied with the universities' websites based on their ease of use. Like the current study,, the participants in Hasan's study's had reservations about the websites' ease of use, especially with regards to the design and termination of the required tasks, as some of the participants were unable to complete the tasks required of them. However, in the

current study, all of the participants in the current research were able to complete all of the tasks assigned to them, in contrast with the situation of participants in the aforementioned studies. Table 16 details a number of weaknesses identified by the participants in Cohort 1, which had an impact on the presence of the selected Libyan universities' websites. In general, the effectiveness of all the websites in the current study were assessed as being weak based on the observations of the participants. In addition, the websites' weaknesses also affected the efficiency of the sites which relates to their usability.

like in the study of Mentes and Turan [21], the usability of the websites in the current study received significant positive attention in satisfying the users' expectations and needs. The results of the current research also did not agree with the work of Hasan [15] who aired views about the limitation of empirical evaluation, in that participants undertaking tasks cannot emulate real users, and therefore cannot predict the actual problems that real users may face when interacting with a website.

The participants in the current study reported many problems with ease of use in addition to failures to meet users' requirements and expectations in the case of the four selected Libyan universities' websites, even though the sites used phrases and words written in a way that was familiar to the participants. There was no statistically significant difference found between the participants' observations of the Libyan universities' websites. The current study found agreement with the study of Roy et al. [20] in saying that timing of tasks completion and user satisfaction levels was in clear contrast between the functions of the universities' websites. However, the time it took for the participants to complete their tasks was found to increase their level of user satisfaction.

In the current study, the Presence 5000s group recorded the highest average time for completion of the assigned tasks, while there was some degree of satisfaction reported by the participants when evaluating this group. In a study conducted by Islam and Tsuji [4] on universities in Bangladesh, the results showed that the advantages of ease of use for university websites did not have the expected strength or quality; which is the same situation as found with the Libyan universities'

websites in the current study in terms of poor webpage navigation, design, content and ease of use.

The satisfaction survey applied to Cohort 2 in the current study indicated that the participants were dissatisfied with the results from the Presence 2000 group due to issues experienced in retrieving the data and information which they were tasked to obtain. The reasons given were incomplete data where information had not been kept up to date on the websites, which thereby negatively affected usability. Also, based on the responses to the satisfaction survey questions, the overall appearance of the interface design for the University of Benghazi's website, in the Presence 5000 group, was considered the most attractive to the participants with the highest mean score among the websites evaluated. Dissatisfaction reported with the Presence 2000 group was due to a lack of data and its timely updating, whereas satisfaction with the Presence 5000 group was due to the quality and esthetics of the website.

In a study by Gullikson et al. [138] on higher education academic communities, emphasis was placed on the importance of having websites on the Internet in order to facilitate communication. Equally, satisfaction of users of university websites is a known factor linked to the success of such institutions. The current study tested the satisfaction of the participants with the universities' websites through Cohort 2 and their completion of a satisfaction survey. The survey was composed of two sections, with the first containing questions about the respondents' demographic data and the second measuring their satisfaction with the website and its efficiency. The results of this study through the variance analysis of Cohort 2 showed that a statistically significant difference was found between all three presence groups, as well as between the presence groups and the level of daily Internet usage (in hours). Use of the Internet was found to be an influential factor in terms of user culture, which had an effect on the usability of the websites. Demographic factors were tested as well as web factors and were shown to have a significant impact on the usability of the websites by the participant users.

The current study also performed pairwise comparisons with adjustment for multiple comparisons. A statistically significant difference was found for the satisfaction of users for the presence groups; between the Presence 1000 group and

the Presence 5000 group, and between the Presence 2000 group and the Presence 5000 group. These results of the current study are therefore consistent with many previous findings regarding of usability and Internet presence. In a study by Joo et al. [133], the results indicated that web presence, the presence of teaching, ease of use, and perceived benefit were expressed as greatly satisfying for learners. The researcher of the current study also agrees with Peker et al. [127], that a university's low online presence does not support ease of use of their institutional website; therefore, usability levels of university websites should be improved in order to increase the organization's web presence on the Internet. Such a statement is consistent with the current study, where weak accessibility negatively impacts the web presence of university websites.

CHAPTER 6

CONCLUSION

The aim of the current research was to evaluate the websites of Libyan universities by way of user testing. This evaluation was administered from the point of view of Libyan students studying higher education in the Republic of Turkey. The study recorded website task completion times of the participants, and the researcher undertook participant observation during the execution of these tasks. Additionally, some of the participants completed a satisfaction survey based on the usability of each of the evaluated websites.

The evaluation of the Libyan universities' websites was achieved through testing the web presence of each university and the ease of use of their websites based on their efficiency and effectiveness, and also from the perspective of user satisfaction. This study concluded that online presence is achieved when universities afford significant importance to their websites by designing sites that are appropriate and fit for purpose, and by the timely updating of data and information on a periodic basis. All of these factors were found to affect the usability of the websites. The evaluation was carried out by collecting data from two cohorts, with a combined total of 61 participants. Cohort 1 was used to measure the efficiency and effectiveness, whereas Cohort 2 was used to measure user satisfaction. The University of Tripoli and the Libyan International Medical University formed the Presence 1000 group, Misurata University formed the Presence 2000 group, and The University of Benghazi formed the Presence 5000 group.

In summary, the study found the following:

First, all of the participants in Cohort 1 negatively commented on the performance of the Libyan universities' websites, reporting their degree of usability as not high. As a result, the websites need to be improved and developed in terms of their design, and in addition, require updates to the data and information they contain.

Second, the information retrieved by the participants according to their assigned tasks was found to be somewhat weak, considering that these websites represent the top four universities in Libya. This negatively affected the effectiveness and efficiency of the websites, as well as the general user satisfaction levels of the participants. Cohort 2, through their answers to the satisfaction survey, reported dissatisfaction with the websites of the Libyan universities in general.

Finally, there were many design-related problems reported by the participants that negatively affected the websites' usability. Therefore, this study puts forward that students should be involved in university website design and testing. Libyan universities should strive to improve and develop the infrastructure of their websites by unifying the design and taking advantage of examples set by competing universities, both within Libya and in other countries.

During the current research, many sections of the Libyan universities' websites were highlighted; however, there were other sections that could be addressed more appropriately in any future research. Also, the four selected Libyan universities do not necessarily reflect the overall picture. Similarly, the application of tasks on the Arabic language web interfaces of the websites was insufficient to adequately assess the total extent to which the websites are used. Future work could aim to increase the number of participants, and also to ensure that the user pool is more diverse and not just limited to Libyan students studying abroad. Future studies could therefore be expanded to select more universities from Libya and also other countries in order to realize and disseminate results on a much larger scale. The results of future studies could also be supported and strengthened by the application of alternative assessment methods in order to evaluate website usability and the web presence of higher education institutions. Future studies could also employ the use of evaluative tools and websites; for example, those that assess web links and measure accessibility.

The study concluded that the websites of Libyan universities need considerable follow-up and development in order to enhance their web presence on the Internet. Additional studies should be undertaken in order to develop the level and standard of websites that should be offered by leading national universities, and to ensure the provision and access to the information required from the website of any university.

In addition, administrations should take note that web presence and website usability are highly dependent upon user satisfaction.

Validity and reliability dimension plays a significant role in the quality of any research results, and adds considerable value to the study. Similar studies could be affected in the future by the development and modernization of Libyan universities' websites. Also, future studies may be affected by the difficulty level of tasks, the number of tasks, the types of participants and the selected websites, and the fact that some participants may or may not be able to complete all of their assigned tasks. In addition, the results of future studies may also be influenced by the selection of different samples from more than one country, or that selecting more websites from Libyan universities may impact on the results of the study.

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APPENDIX A.   Satisfaction Survey

Section 1

1. Gender
     O Male
     O Female

2. Age
     O 20-35
     O 36-50
     O 51 or above

3. Education level:
     O Bachelor's degree
     O Master's degree
     O Doctoral degree

4. I use the Internet approximately?
     O Less than four hours
     O Less than six hours
     O Six hours or more

1.   **I found it difficult remembering how to use the university's website when performing tasks**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

2.   **I felt comfortable with the use of the university's website**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

3.   **I am satisfied with the usage of the university's website**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

4.   **I felt comfortable with the university website's usability**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

5.   **I managed to obtain the required information easily**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

6.   **I enjoyed using the university's website**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

7.   **I am attracted to the university website's design**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

8.   **I am satisfied with the results obtained from the university's website**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

9.   **I found the university website to be understandable**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

10.   **I found the university website to be helpful**

O Strongly agree **O** Agree **O** Neither agree nor disagree **O** Disagree **O** Strongly disagree.

APPENDIX B.   Home Pages of University Websites

1. Home page, University of Benghazi website (http://www.uob.edu.ly

The University of Benghazi was in the Presence 5000 group.

Figure B. 1

2. Home page, University of Tripoli website (http://uot.edu.ly)

The University of Tripoli was in the Presence 5000 group.
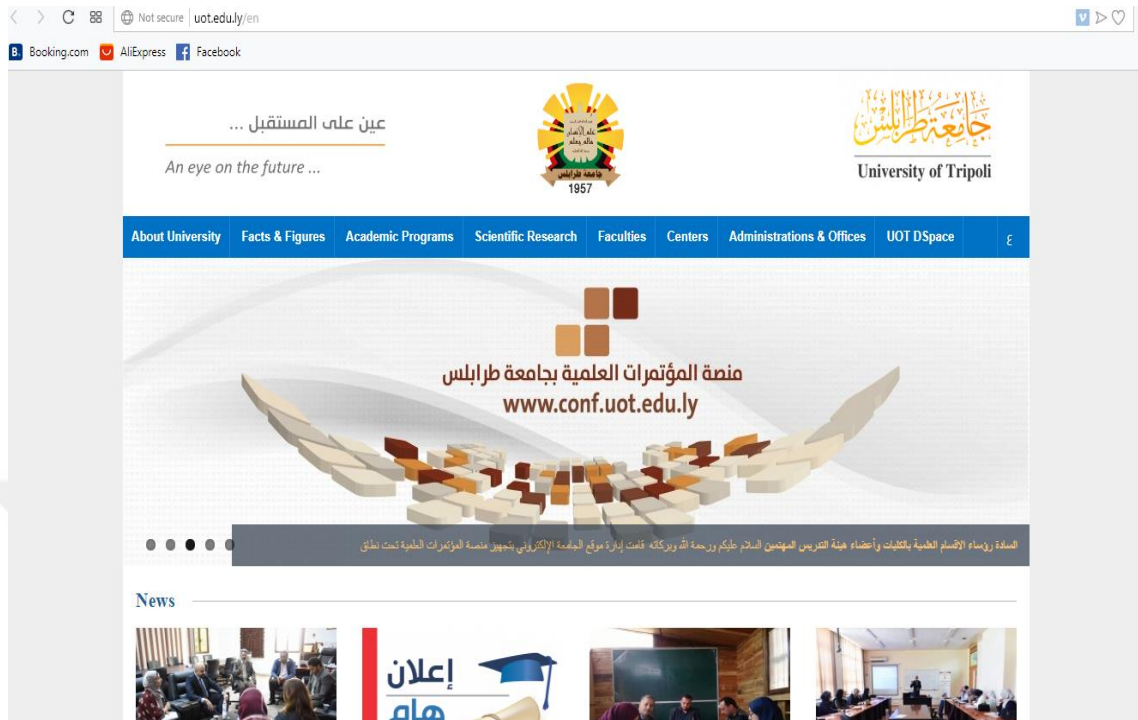
Figure B. 2

3. Home page, Misurata University website (http://www.misuratau.edu.ly)

The Misurata University was in the Presence 2000 group.
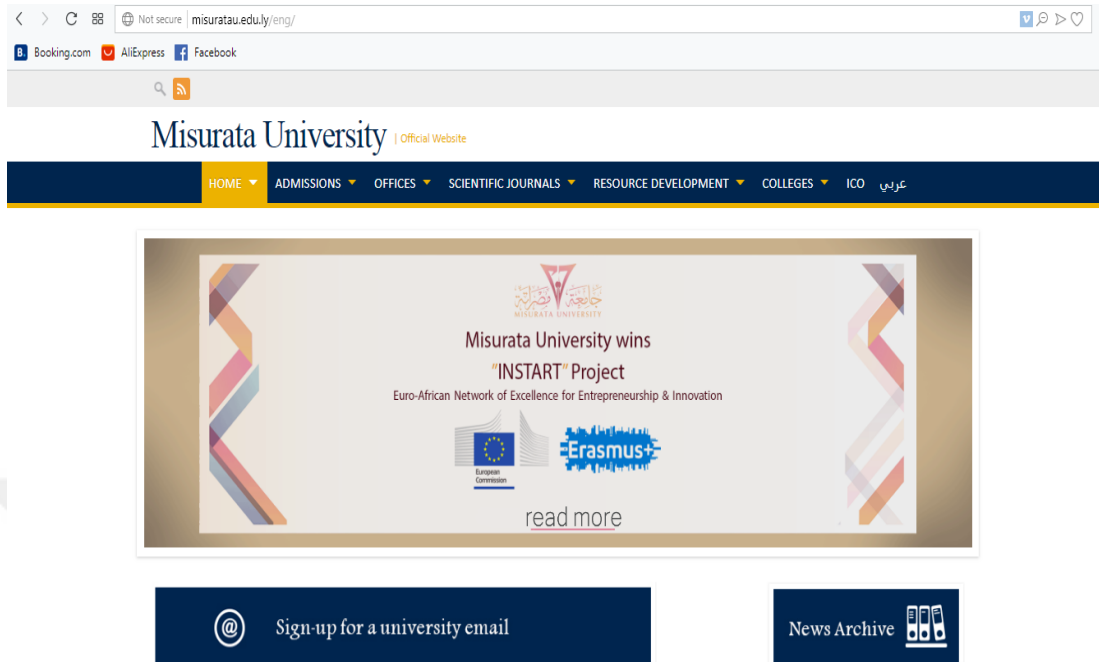
Figure B. 3

4. Home page, Libyan International Medical University website
(http://limu.edu.ly)

Libyan International Medical University was in the Presence 1000 group.

Figure B. 4