Evaluation of University Library Websites in Pakistan: Usability & Accessibility Analysis

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Evaluation of University Library Websites in Pakistan: Usability & Accessibility Analysis

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Research Report submitted in partial fulfilment of the requirements for the degree of M.Phil. in Library and Information Science, University of Sargodha, Pakistan

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DEDICATION

This work is dedicated to my Creator (for the wisdom He bestowed in me) then to my parents for their guidance and my family for their substantial support.

CERTIFICATE OF SUPERVISION

This is to certify that the research work entitled **"Evaluation of University Library Websites in Pakistan: Usability & Accessibility Analysis"** has been conducted by Mr. Arif Khan, M. Phil Scholar, Department of Library & Information Science, University of Sargodha, under my supervision. The data presented in the thesis are original and fairly collected from the field.

This thesis is submitted to the University of Sargodha in partial fulfillment of the requirements for the award of degree of Master of Philosophy (M. Phil.) in Library and Information Science to Mr. Arif Khan.

Dr. Haroon Idrees
Supervisor

DECLARATION

I declare that the work presented in this thesis is, to the best of my knowledge and belief, original and my own work, except as otherwise acknowledged in the text. The material has not been submitted, either in whole or part, for a degree at this or any other university. Moreover, necessary permissions/informed consent have been obtained from the respective organizations being subject of this research work.

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ABSTRACT

This study aims to conduct evaluation of university library websites in Pakistan based on International standards of *web usability* and *web accessibility*. This study examines the usability of library websites of top-ten Pakistani universities (as ranked by Higher Education Commission, Pakistan) according to guideline checklist provided by International Organization for Standardization (ISO) 9241 –standard for Ergonomics of human-system interaction -- Part 151: Guidance on World Wide Web user interfaces. Besides usability standards, the subject websites are also examined for the level of compliance to International web accessibility standards.

Heuristic evaluation method is used to evaluate web usability where the subject websites are examined through representative users for content design, navigation, search, content presentation, and general design aspects of the user interfaces of library websites. Accessibility evaluation was conducted using *web accessibility evaluation tools*(WEATs) to check the level of conformance to international web accessibility standards i.e. Web Content Accessibility Guidelines (WCAG 2.0). The study identifies major usability and accessibility barriers of the library websites and offers recommendations on the basis of research findings of the study. Suggestions for improvement of web usability and accessibility have also been framed in order to communicate it to the respective organizations.

This study concludes that 60% library websites were found to have satisfied maximum ISO Usability guidelines while the remaining 40% does not. Whereas, 50% percent library websites contains serious Accessibility issues. However, some major usability components were found missing, which certainly affect the users to use these websites effectively.

Ascertaining the contents of subject websites for accessibility issues, it was observed that multiple issues regarding “priority A” (an ISO standard) level accessibility were found in the studied websites which means that some “special persons” would find it impossible to use these

websites. Developers must resolve these issues so as to enable all users to access the website contents easily. Half of the total websites, (50 percent) were in much better condition. However, there were Priority AA (an ISO standard) and AAA (an ISO standard) level issues in almost all studied websites.

Categorically it is found that all studied websites have common usability problems which require serious attention of both the website developers and professional librarians in order to make their website more usable and effective.

1. INTRODUCTION

1.1 Overview

The goal of a website is equal and ubiquitous information dissemination for all people, whereas technical standards are indispensable for meeting that goal. First and foremost, Website is a mean of communication; build for four reasons i.e. Information, business and marketing, entertainment, and personal. Information, however, is the most fundamental purpose of all types of websites. A website is generally and particularly accessed and used for informational or corresponding purposes. Nielsen and Tahir (2002) argue that website is the virtual face of an institution, responsible to interact with the external world. Obviously this interaction is meaningful only if the website is designed with refined features.

A library website is an extended service of the library. Of course number of activities comes under the umbrella of this extended service and it is therefore, that a library website is better assessed and evaluated if done according to internationally acceptable criteria and standards. Turner (2010) pointed out that such traditional approach cannot do justice to evaluate the library websites, "…measuring effectiveness of library websites has historically focused on tracking crude effectiveness measures, usually in terms of hits/visits, asking users, comparing items checklists etc."

According to Callicott (2002) a library website is required to bring certain links closer to the homepage and to present meaningful labels that make sense to all users, not just library professionals. The present study is aimed at detailing with several other aspects—internationally recognized to be essential for a website. Therefore, considering International Standards and guidelines both for examining accessibility and usability problems of library websites is no exception.

Libraries are providing Web-enabled services and therefore, attention is being focused on designing easy-to-use, user-friendly and manageable web interfaces for libraries (Jiann-Cherng & Chih-Feng, 2009). Many researchers like Konnuret et al.(2010), Swanson and Green (2011), Walia and Gupta (2013) argued resoundingly that library website quality is judged alongside two dimensionally, namely richness of contents (accessibility) and ease of use (usability).

Currently most of university libraries in Pakistan have established their websites, do these websites meet users' requirement in practice? Functionality, design and usability are critical if libraries strive to continue providing important services to their patrons timely and efficiently (George, 2005). Thus, usability evaluation is essential for determining whether a website meets the needs of its general users. Conway (2011b) quote Lilly, 2000 "…an effective public library website requires a presentation and organization that allows users to know all that the library has to offer electronically". Similarly Poll (2007) argues that normal user spends around 35 seconds looking at the homepage whereas expert user spends about 25 seconds which means that first 35 seconds are crucial to attract the user regarding contents of any website.

It is generally difficult to renew the existing websites in order to meet the changing demands of users. The aim of this study is to promote university libraries to improve their design, content, service function, and technical compatibilities of the websites of their libraries by identifying and communicating modifiable defects of their existing websites. Thus, to suggest them ways to be able to provide effective, fast and satisfactory services to their users along with making competitive recognition worldwide.

1.1.1. Introduction to library website evaluation.

What is the primary purpose of a library website? Is it to provide services to the users (students, faculty, staff; for academics); Is it to market a library to its local community (whatever that is)? Is it to market library to the world?. A primary purpose of any type of library is to meet

the informational need of its community. Following the philosophy to meet this objective, a library is required to provide equal access to academic and scholarly material to its patrons. Shorpshire, as quoted by Konnuret et al. (2010) added that library "website serves as the primary tool in delivery of services".

Library website evaluation is not a new concept. Stover and Zink (1996) conducted one of the first general evaluations of academic library Web sites. Around the same time, Clyde conducted one of the earliest evaluations of public library and school library home pages (Clyde, 1996; Powers). Librarians conducted early studies of academic library websites based on the works of the first professional usability experts, such as Jakob Nielsen, Jeffery Rubin, and Jared M. Spool (Letnikova, 2003)

In the last 14 years, industry standards have been developed for both Web site assessments in general, and specifically, for library Web site effectiveness and evaluation. These standards include OCLC's *Fourteen heuristics used in OCLC heuristic evaluations* (Edmonds, Stephenson, & Ashmore, 2003), based on Nielsen's *Ten usability heuristics*(Nielsen, 2005); *W3C Web Content Accessibility Guidelines* (Caldwell, 2008); and *Research-Based Web and Usability Guidelines* developed by the United States Department of Health and Human Services (Koyani et al., 2004).

As we know the websites are accessed by mass public including those having certain physical disabilities, therefore, it is germane that the website be accessible to all in equal terms.

1.1.2. Introduction to Web Usability.

The term "usability" is generally considered as "the ease of use and learnability of a human-made object". The word "usability" also refers to methods for improving ease-of-use during the design process. The object of use can be a software application, website, book, tool, machine, process, or anything a human interacts with (Upasani, Jagtap, & Paymal, 2012). Web

usability study is normally conducted by researchers, designers, marketing personnel, and technical writers for different purposes such as performance evaluation, analysis, development, redesigning and restructuring of a website.

International Organization for Standardization (ISO) defines usability as "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use". Jakob Nielsen (usability expert) and Ben Shneiderman (professor of Computer Science) separately written about a framework of system acceptability, where "Usability" is considered as "Usefulness". This framework is composed of five components as under[1]:

Learnability: It's about the ease of use and the way users accomplish basic tasks when they confront with that particular system (i.e. software, website etc.)

Efficiency: after learning about the design, how quickly users can execute certain activities and perform tasks?

Memorability: How easily users can re-establish their proficiency with using the system when it is not used for a long period.

Errors: How users make errors in using the system? And how easy is for the system and the users as well to recover from such errors?

Satisfaction: Are users satisfied working with the system?

Usability is a quality attribute that assesses how easy user interfaces are to use. It also refers to the process of improving ease-of-use. Whereas, usability evaluation means different parameters and criteria as mentioned above to be ensured and checked while evaluating a website. As discussed earlier, usability is how easy an object is to use while the object can be

[1]http://www.nngroup.com/articles/usability-101-introduction-to-usability/

anything that a person can interact with should be usable i.e. a machine, tool, process, book, software application or website.

Web usability is simply known as the ease at which an average person can use the software or website to achieve specific goals. Battleson et al. (2001) while conducting usability study, insist that there is a fundamental need for "usability" in library Web sites and usability testing is an invaluable tool for evaluating interfaces in terms of their effectiveness and ease of use.

There are different standards for measuring Web usability (discussed at length under section 1.1.6). However, the ISO, being widely accepted standardization agency has described usability aspect in its document ISO 9241:2008. Part 151 – *Guidance on World Wide Web user interface*, of the said document discusses the usability of web application's user interface. ISO 9241-151 focuses on the design aspects, and provides design guidance and recommendations in four major areas i.e. content design, navigation and search, content presentation, and general design aspects.

1.1.3. Introduction to Web Accessibility

Based on the different points of view, there are various definitions of web accessibility. According to Wikipedia[2] in simple words "Accessibility is the degree to which a product, device, service, or environment is available to as many people as possible. Accessibility can be viewed as the 'ability to access' and benefit from some system or entity".

The concept often focuses on people with disabilities or special needs (such as the Convention on the Rights of Persons with Disabilities) and their right of access, enabling the use of assistive technology. According to Henry, (S. L 2005) "Web accessibility means that people with disabilities can use the web". Web accessibility has been a burning issue worldwide because

[2] http://en.wikipedia.org/wiki/Accessibility

people with any kind of disability can face more difficulties using the web. A normal person can have better access to web and its contents. In order to ensure that the disabled people are able to benefit from the Web, this issue has been addressed in UN convention on the rights of Persons with Disabilities. According to ISO 2008 accessibility is defined as the "usability of a product, service, environment or facility by people with the widest range of capabilities". There are varieties of guidelines and tools to allow web accessibility but the most relevant ones are W3C, ISO and Section 508 (Sahib, Hussain, Ismaili, & Bukhari, 2012).

Web accessibility refers to a set of activities of making websites usable for all types of people either able or disable. The disability does not only encompass physical disability but also cognitive, speech, visual, auditory and neurological. If a website is correctly designed and implemented and maintained on known technologies and with required standards, it is then accessible to all users equally. For example, a semantically coded HTML with alternate equivalents for images and meaningfully linked website helps blind users to use text-to-speech software easily to use the website. Similarly, when text enlargement option is available and the clickable links are underlined as well as colored on the website, it becomes easier for users with low vision or color blind to read, notice and understand the contents. When a website is properly coded it can be used without a mouse so users who cannot use a mouse with precision can use the website effectively with keyboard or any other input device. People suffering from dyslexia and learning difficulties cannot easily understand the contents if written in plain language and/or illustrated with appropriate diagrams. Flashing text and animation are also required to be available with pause or stop option so as to avoid putting users with balanced disorders at risk.

Web accessibility encompasses all disabilities that affect access to the Web, including physical, psychological, mental and neurological. The document "*How People with Disabilities*

Use the Web" (available via http://www.w3.org/WAI/intro/people-use-web/Overview.html) describes in detail how different disabilities can affect people to use Web.

Notwithstanding the fact that Web accessibility benefits disable people to use web, it also benefits normal people (without having disabilities) equally. Let us see, a fundamental standard of Web accessibility is to designing software and website which are flexible, meeting users' needs, their preferences and situations. This encompasses the issues like using internet with low bandwidth, addressing issues of people with changing abilities due to aging factor and temporary disabilities such as broken arms. The document "*Developing a Web Accessibility Business Case for Your Organization*" (available via http://www.w3.org/WAI/bcase/) describes different benefits of Web accessibility, including benefits for organizations.

Web is the source of information for the people of all age groups of community. Society comprises of normal persons and of those who have any kind disability called People With Disability (PWDs). Fundamental human right recognized in the UN Convention on the Rights of PWDs, particularly indicate the internet and other accessible information and communication technologies (ICTs). The UN convention on the rights of PWDs, signed on 30th March 2007 by 132 countries throughout the world says clearly that "…PWDs should be able to live independently and participate fully in all aspects of life…PWDs should have equal access to the physical environment, to transportation, to information and communication technology, and to other facilities and services open or provided to the public" (Section & I., 2006). It is, therefore, that PWDs shall no more be deprived of benefiting the services, which normally provided through websites. Studies reveal that currently websites are three times more accessible by the normal persons than PWDs.

Many researchers (described in detail in Section 2.4)argue that low web accessibility at of library websites reflect lack of awareness about this burning issue among library science professionals (Schmetzke, 2001).

1.1.4. Methods of Website Evaluation

Primarily there are different methods of website evaluation. Iqbal and Warraich (2012) described commonly used methods for website evaluation and usability testing. However, dominant notion of website evaluation portrays two concepts i.e. Evaluation with user participation, and Evaluation without user participation (Poll, 2007). Table -1 shows a brief description of methods of both concepts of website evaluation.

Generally, website evaluation methods are grouped into five categories by Patrie and Bevan (2009) as under:

1. Automated checking of conformance to guidelines and standards
2. Evaluations conducted by experts
3. Evaluations using models and simulations
4. Evaluations with users or potential users
5. Evaluation of data collected during Web usage

Similarly, the evaluation tools and techniques are also very important for authenticity of information they produce. There are different evaluation methods used time to time to evaluate the website according to the purpose and objectives. For example most common methods include focus group, participatory design, surveys, card sorting, contextual task analysis, cognitive walk-through, quality assurance testing, heuristic evaluations, one-on-one interviews, and charrettes, (Bevan, 2005).

Table1
Methods of Web Site Evaluation

Evaluation with user participation	
Web surveys:	Surveys are conducted to assess users' satisfaction rates, identification of problems, purpose of access etc.
Group tests:	Group of people work together on specified tasks while moderated by web experts.
Transaction Logs:	Examining the website transaction data i.e. most used pages, searching queries and frequency of access.
Focus Groups:	Web site is discussed with small group of website users who express their experiences, findings and problems.
Observation:	Users perform a set of activities while observed either through video or human observer.
	A test user's verbalizing his or her thoughts when searching is recorded on tape.
Think-aloud Protocol:	Representative users verbalize his/her thoughts while searching which is recorded on tape.
Evaluation without user participation	
Heuristic evaluation:	Group of expert evaluators read the entire website and evaluates each component based on a set of recognized principles/standards.
Cognitive walk-through:	Experts construct a "user scenario" and perform tasks of an imaginary user

Nevertheless, researchers are commonly agreed that all of these methods consider the common properties of any website i.e. Credibility, Accuracy, Responsibility, and Support (CARS).

1.1.5. Heuristic method of website evaluation

The most popular type of expert evaluation is heuristic evaluation (Nielsen, 1994, 2001). Heuristic evaluation method primarily involves a small group of evaluators examining

"eSystem" to ascertain possible usability problems. This method was originally proposed by Jakob Neilsen which was further adapted peculiarly by many researchers. For example, examining individual components by evaluator has been combined with asking the evaluators to execute typical user tasks in order to evaluate the functionality also. This combines the benefit of Heuristic Evaluation with Cognitive Walkthrough method.

In Heuristic Evaluation, expert evaluators use a set of heuristics (commonly recognized principles) to evaluate the subject eSystem (i.e. software, website, etc.) and rate the potential problems for its severity and importance. Nielsen (2001) suggest involvement of several evaluators (usually 3 to 5) because research shows each individual typically finds only one third of the problem. Desurvire, Kondziela, and Atwood (1992) supports that heuristic evaluation can be carried out by people who are not trained in usability methods however, better results can be obtained using trained experts.

Evaluators may also work together as group to identify problems but individual and private rating is essential to avoid biasness and possibility of influencing each other's findings while this is called Cello Evaluation (Petrie & Bevan, 2009). Hvannberg, Law, and Lérusdóttir (2007) found that "It is often difficult to get agreement between the evaluators on exactly which heuristic is associated with a particular potential usability problem". Research studies show that heuristic evaluation is more accurate, reliable and consistent to identify major usability problems of a website. Looking at different sources, it can be well concluded that heuristic evaluation works well because:

- To identify as many accessibility and usability issues as possible in order to eliminate them;
- there are too many pages or screens to be included in user-based evaluations;
- it is not possible to obtain actual or potential users for evaluations;

- there is insufficient time for user testing; and to train developers in accessibility and usability issues;
- it can provide some quick and relatively inexpensive feedback to designers;
- assigning the correct heuristic can help suggest the best corrective measures to designers;
- it can be used together with other usability testing methodologies;

1.1.6. International Standards and Guidelines for Website Evaluation

The key terms of Quality Assurance are "Usability" and "Accessibility" as defined by International Organization for Standardization are[3]:

Usability: "the extent to which a product (website) can be used by specified users, to achieve specified goals, with effectiveness, efficiency and satisfaction, in a specified context of use" (International Organization for Standardization, 1988).

Accessibility: "the usability of a product, service, environment or facility (website) by people with the widest range of capabilities" (International Organization for Standardization, 2002).

1.1.6.1. Web usability standards.

"Broad goals of usability are the presentation of information and choices in a clear and concise way, a lack of ambiguity and the placement of important items in appropriate areas" (Taş & Nanehkaran, 2013). Keeping in view this broad goal, different standards have been devised time to time in order to measure the web usability. However, set of Usability Guidelines published by International Organization for Standardization (ISO), usability guidelines developed by U.S. Department of Health and Human Services (HHS), and usability guidelines

[3] http://erg.bme.hu/oktatas/tleir/ergpsy/website_evaluation.pdf

for academic website published by Joint Information Systems Committee for higher education (JISC) U.K. are known to be in best practice.

1.1.6.1.1. Overview of HHS and JISC.

HHS web usability guidelines are developed by U.S Department of Health and Human Services with a background of dire need that usability guidelines and the quality of existing web designs are tend to be uneven. Koyani et al. (2004) explains that usability guidelines does not itself explains which guidelines are relatively important and have most research to support, even some of them have to be meaningfully clear with sufficient examples. The objective of developing HHS guidelines was to introduce research-based practice in a meaningful format both readily understandable and easy-to-use. Finally a set of 187 guidelines particularly for information-oriented websites were developed out of 375 cited publication. The guidelines have been ranked for importance based on ratings provided by 8 website designers and 8 usability specialists (Health & Services, 2006).

JISC (Joint Information Systems Committee for higher education U.K.)is primarily responsible to provide web resources for higher education in the United Kingdom. A research study was presented by Bevan and Kincla (2004) from the platform of JISC having different objectives. The primary goal of this study was to identify how usability guidelines could assist the users and analyze these guidelines for its applicability to JISC services and resources. Similarly it also reviewed current practice for support of learning, teaching and research in the UK and other relevant countries. Over 200 publications were reviewed and finally JISC presented 121 widely applicable web design guidelines extracted from 32 publications (Bevan, 2005).

1.1.6.1.2. ISO 9241-151

ISO (the International Organization for Standardization), a worldwide federation of national standards bodies (ISO member bodies) is responsible for preparing International Standards through its technical committees. International, governmental and non-governmental organizations collaborate with ISO in this work. ISO also collaborates with International Electrotechnical Commission on the matter of electrotechnical standardization. These standards are prepared in accordance with rules available in collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization. International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2. ISO 9241-151:2008, Ergonomics of Human-System Interaction: Guidance on World Wide Web user interface.

Part 151 – *Guidance on World Wide Web User Interface* covers the usability aspect of ISO 9241:2008 Standards -*Ergonomics of human-system interaction.* ISO 9241-151:2008 presents guidance on the usability of web application's user interface. This standard focuses the web user interface in four major areas namely:

- Purpose and strategy
- Content and functionality
- Navigation and interaction
- Media design and presentation

Purpose and strategy discusses useful guidelines about how and what of the purpose of web application. Content and functionality is primarily dealt with at conceptual aspect of organization of website contents along with how web application may consider the issues of personalization, privacy, and security etc. Navigation is no doubt an important aspect and the ISO guidelines discuss how it should be structured for ease, objectivity, and understandability.

Similarly, in Presentation and media design section these guidelines dilate upon how the information be presented in the best suitable form.

Professor Juergen Ziegler at University Duisburg-Essen, Germany edited the first draft of the ISO 9241-151 which was circulated for international vote in 2004. The draft was accompanied by various comments and the revised draft was until the final version was got approved leading eventually to a published International Standard in 2008.

ISO 9241-151 provides more comprehensive set of guidelines for web user interface. It provides general principles and guidelines as well as specific solutions with examples in many cases. This approach not only explains the relevant guideline but also helps in devising attainable and verifiable criteria for a good evaluation. Proper navigation and good searching are the fundamental requirements for an effective library website. Whereas, ISO 9241-151 has more comprehensive guidelines for topics such as navigation and search, and as an International Standard, it carries authority and reach a wide audience(Bevan & Spinhof, 2007). It is, therefore, that ISO 9241-151 were chosen for this study.

1.1.6.2. Web accessibility standard.

World Wide Web Consortium's (W3C) Web Accessibility Initiative (WAI) has established accessibility standards and guidelines both for development of new website and evaluation of already developed websites. “These guidelines are named as Web Content Accessibility Guidelines (WCAG), the web developer must follow these guidelines in order to make their sites accessible for all people especially people with any kind of disabilities”. These are more accurately testable with automated testing tools and human evaluation also (Hassanzadeh & Navidi, 2010). WCAG 1.0 and WCAG 2.0 were published in May 1999 and in December 2008 respectively.

WCAG 2.0 standards and guidelines have been devised and made international by the W3C consortium and first published in July 2005 (Abascal, Arrue, Fajardo, Garay, & Tomás, 2004).Worldwide, there are multiple research studies conducted on evaluating accessibility of websites as per W3C's accessibility guidelines, Section 508 of US for disabled.

Web contents accessibility recommendations are categorized into following groups (Bakhsh & Mehmood, 2012) presented in Table-1.Web Content Accessibility Guidelines (WCAG) 1.0 and 2.0 is a stable, referenceable technical standard. There are 12 guidelines organized under four principles i.e. perceivable, operable, understandable, and robust. Testable criteria have been defined for each guideline which is at three levels: A, AA, and AAA.

Table 2
W3CPriority Categories

S.No	Description	Symbol
1	Essential guidelines to be followed by the developers in order to make all information accessible for all types of users.	A
2	These should be followed by the developers to remove important accessibility issues and barriers that cause inaccessibility of information on a website.	AA
3	These guidelines are not much important, however, these may be followed in order to make website more comfortable for the use of people with any kind of disability.	AAA

1.1.7. Relationship between Usability & Accessibility

Usability and accessibility is often considered overlapping each other, and there is not a clear distinction between them. In most situations, differentiation between them is not needed, because they are complimentary to each other and supports in many ways. There are a few cases when the distinction is important, such as when looking at discrimination against people with disabilities and when defining specific accessibility standards (Reis, Barroso, & Gonçalves, 2013).

Sohaib, et al. (2012) argue that "Customer and end users is one of the key factors, to satisfy them, a website must fulfill some common needs: availability, responsiveness and clarity". The purpose of 'Usability' is to create/design a user responsive product and present in such a way that satisfies the users during execution/use in effective and efficient manner. 'Accessibility' relates to the aspect that who is using the site (e.g. people having slow connectivity to WWW, normal/abnormal, elderly, children, people having vision or/and hearing difficulties, etc.)

W3C or World Wide Web Consortium is an international consortium (www.w3.org) discusses the Usability and Accessibility at length as **"Usability** means designing your products and services to be effective, efficient, and satisfying. User-centered design (UCD) focuses on usability goals, user characteristics, environment, tasks, and workflow in the design of an interface. UCD is an iterative process with well-defined methods and techniques for analysis, design, and evaluation from the first stage of projects, through implementation". Whereas "**Accessibility** focuses on including people with disabilities as the 'specified users' and a wide range of situations, including assistive technologies, as the 'specified context of use'". With the rapidly developing WWW, the quality of websites is ever increasing day by day. Both the Usability and Accessibility aspects regulate the Quality Assurance (QA) approach regarding website evaluation.

1.2 Background of the study

Library Web Site is a gateway to knowledge repository of any academic institution. Website is an intellectual interface of any academic organization through which it correspond to the world.

University is considered a center of higher education, scholarly, and research platform; has its own pivotal role to play in the development of a country. University library is certainly a

place where dignified academic material is available to scholars, researchers, and students. Considering the components all together, the university library being a repository of scholarly material, and a website being its interface to the world, one can better judge the level of importance of a university library website. A university library website supports the intellectual growth of any community which ultimately leads to socio-economic change in the society.

This is also pertinent to mentioning that library websites are abhorrently ignored for evaluation of accessible contents. In fact, talking about Pakistani library websites, a few usability studies are available (although without considering international standards) but no accessibility study has been conducted so far. It is, therefore, that Pakistani library websites required to be evaluated in accordance with international guidelines in order to suggest appropriate measures to make them more accessible and usable for people of all types.

Research on website evaluation by Mousavi and Marthandan (2012) reveals that UK and Irish website passes an average number of criteria. Whereas, Pakistani and Indian websites are slightly failed to conform to international guidelines as compared to West African websites. However, the research concluded that international standards developed in United States and Europe are more preferred in their own region. However, the aforementioned study is also based on HHS guidelines and not on ISO guidelines for website evaluation.

1.3 Theoretical Framework

As we know that library websites are the source of scholarly and academic material. Evaluating library websites have been the center focus of researchers. Historically, different checklist proposed and developed by the Usability Experts like Jakob Neilsen and Jeffery Rubin etc. were used to evaluate library websites. Ample research is available on evaluation of university library websites worldwide. However, considering ISO standards for heuristic evaluation of library websites has never been considered. This study focuses on evaluation

approach using the International Standards both for usability and accessibility issues. International standards provide strong level of authenticity and confidence over the chosen criteria. It was also found that no such study has ever been conducted to evaluate library website using ISO checklist. Similarly, the researcher also attempted to translate ISO guidelines into understandable, verifiable and attainable checklist for evaluators because often guidelines itself are vague and ambiguous to be used directly for evaluation purposes. Thus, in doing so the present study attempts to bridge the library website evaluation process with recognized and widely accepted international standards and guidelines.

1.4 Statement of the Problem

In the last few years, there are significant numbers of library websites developed in Pakistan. While taking initial search overview on functional library websites, it is found that most of library websites are not developed according to standards and therefore, are not useful for their patrons the way it should be. Universities, however, take advantage of developing and maintaining their websites regularly which in turn helps develop the library to extend its services through the university's website.

McGillis and Toms (2001), Nielsen and Tahir (2002), Yates (2005) and so many other researchers pointed out that Accessibility and Usability are the yardsticks to examine and evaluate the websites effectively. However, measuring effectiveness of library websites has historically focused on tracking crude effectiveness measures, usually in terms of hits/visits, asking users, comparing item checklists etc. At the other hand ISO has established International Standards also with checklist to evaluate usability of Web User Interface which has never been taken into consideration by the library researchers while evaluating Library Websites especially for usability studies. "Libraries are served poorly through this approach, as websites represent a unique and increasingly important aspect of the organization and should require more specific

and custom measures of effectiveness" (Turner, 2010).Thus, there is an increasing demand to understand and evaluate the Library Websites in context of what International Standards require. The aim of this research is to evaluate the university library websites according to international standards/guidelines.

Keeping in view the increasing demand of Pakistani library websites' conformance to international standards, it is pertinent to evaluate the usability and accessibility of library websites in Pakistan. To meet this objective, two sub-problems were identified as under:

1.4.1 Sub-problem 1:

It is significant to identify the usability and accessibility problems in library websites of Pakistani top-ten Universities, on the basis of being considered widely utilized library websites in Pakistan.

1.4.2 Sub-problem 2:

It is substantial to evaluate the level of conformance to international standards and guidelines by the subject library websites.

This study aims to develop unbiased consensus on consolidated issues and problems of library websites in Pakistan based on ISO standards so as to take preventive action for improving usability of web contents of library websites by the respective universities for educational and research purposes.

1.5 Research Objectives

In light of Benjamin Bloom's taxonomy of educational objectives[4] (i.e. action, condition, and criteria) the following research objectives are framed for this research study:

[4]Forehand, M. (2010).Bloom's taxonomy. Emerging perspectives on learning, teaching, and technology, 41-47.

- To evaluate university library websites in Pakistan in order to check its compatibility with international standards.
- To identify usability issues of university library websites according to internationally recognized usability and accessibility standards and guidelines i.e. ISO 9241-151:2008, and WCAG 2.0.
- To formulate suggestions and recommendations for improvements of usability and accessibility of subject websites on the basis of research findings

1.6 Research Questions

This study attempts to find answers of the following research questions related to university library websites (ULWs) in Pakistan. The study answers the following research questions:

1. Do University Library Websites of Pakistan comply with international standards for web usability (Defined by ISO.)?
2. What is the level of compliance of subject websites to the ISO 9241-151:2008 usability guidelines?
3. What are the accessibility issues of university library websites in Pakistan?
4. What are the major shortcomings of University Library Websites in Pakistan to comply with ISO 9241-151:2008 guidelines?

The data collection and analysis process was further guided by focused approach as to find out either library websites of Pakistan have user friendly interface?, what are contents, language, structure, design, and navigation issues in university library websites in Pakistan?, and which errors mostly affect the usability and accessibility of a library website?

1.7 Significance of the Study

Users of the World Wide Web experience problems of inconsistency between websites and often even within the same website. For example, a simple and straightforward link can easily be misled by underlining on page-one, mouse roll-over on page-two, and nothing at all on page-three of the same website.

Likewise, using automatic online web auditing tools has also provided more authenticated and verifiable information about the components that human-evaluators cannot identify merely through surfing or visiting the website.

The purpose of having a website that meets usability and accessibility guidelines is to enable as many people as possible to use it easily and effectively. An accessible Web can also help people more actively participate in society. Another important dimension of this study is to evaluate the library website contents for accessibility issues which in turn address those people who have any kind of disabilities to access the information i.e. cognitive, physical, technological, or low literacy rate. Thus supporting the basic human right as recognized in the *UN Convention on the Rights of Persons with Disabilities*[5], which demands an equal access to information for all kind of people.

This study is significant in many ways first that it considered both perspectives of a website evaluation; the user's perspective and the developer's perspective. By testing through guideline review, based on international standard, it examines all aspects of usability and accessibility of websites according to International Standards. Secondly this study combines both the usability and accessibility issues which present an overall picture of a website. Thirdly the study adopted dual approach of evaluating library websites from usability (using checklist) as well as accessibility (using WEATs) viewpoint. Fourthly this study provides extensive literature

[5]Convention on the Rights of Persons with Disabilities. (October 16, 2013), from http://en.wikipedia.org/w/index.php?title=Convention_on_the_Rights_of_Persons_with_Disabilities&oldid=577438374

review on methods, techniques, processes, and standards of website evaluation with special focus on library websites. Fifth that this study examines the websites through online Web Accessibility Evaluation Tools which provide more authenticated and verifiable information about the components that human-evaluators cannot identify merely through surfing or visiting the website.

1.8 Scope of the Study

According to HEC's recently published document[6]there are 135 chartered Universities and Degree Awarding Institutions (DAIs) in Pakistan. Primarily, it was intended by the researcher to include all university library websites in this study but initial search on functional library websites of Pakistan revealed that mostly websites does not provide web-based services and are built for informational purposes only. Secondly, most of the websites are comprised of single web page instead of a complete website. It is, therefore, decided that library websites of top-ten universities of Pakistan, as ranked by Higher Education Commission, may be selected for this study in order to be able to evaluate the complete website in accordance with International standards.

Third factor that defines the scope of this study is that Usability evaluation of websites is dealt with separately than usability evaluation of other types of software, mainly because library websites constitute a special category of web applications. Specific properties, purpose and objectives of library websites relating to their design and usage demand the need for more watchful evaluation and tailored modifications of the evaluation criteria/techniques. One of the core properties of library website is to present information to the user which implies the need for specific architecture for navigation and information, especially a good way of presenting site contents or of implementing information searching-related features (Cheng, 2011). McKay

[6]http://www.hec.gov.pk/ourinstitutes/pages/default.aspx

(2013) found another problem with library website usage is that "they are rather superficially scanned by users than read through, which in turn also implicates special design decisions". For this reason ISO standards were considered as a whole while the Section 8 and 9 were taken in particular to focus on contents (e.g. design, structure, presentation).

1.9 Definition of Terms

Below is the alphabetical list of terms along with their definitions used throughout this study. A short and brief description is also given at the appropriate place where the term arrives, however, additional links to further explanation for each term (if required) have been given in this section.

S.No	Term	Definition
1.	FAE	Functional Accessibility Evaluator, free online tool for evaluating website contents developed by University of Illinois
2.	Heuristics	Set of internationally acceptable principles/guidelines
3.	ISO	International Organization for Standardization
4.	ISO 9241-151	ISO standard for Web User Interfaces. The document supports and provides guidelines both for already developed and newly created websites. It also provides a checklist to evaluate the developed websites for usability issues.
5.	SiteSort	Professional/commercial online tool for evaluating website contents; used by many researchers and authenticated its reliability and validity in terms of accuracy. Developed by PowerMapper Corporation
6.	W3C	World Wide Web Consortium (W3C) is an international community and the main international standard organization for World Wide Web founded in 1997 by Tim Berners-Lee (the founder of WWW). Its mission is to lead the WWW to its full potential by developing protocols and guidelines to

		ensure long-term growth of the web. For more information please visit http://www.w3.org/Consortium/
7.	WAET	Web Accessibility Evaluation Tools described by World Web Consortium (W3C) are software programs or online services that help determine if a Web site meets accessibility guidelines. Complete list of different WAETs is available at http://www.w3.org/WAI/ER/tools/complete
8.	WAI	Web Accessibility Initiatives (WAI) is a technical specification for making dynamic, interactive Web content accessible to people with disabilities. It develops guidelines widely regarded as the international standard for Web accessibility; develop support materials to help understand and implement Web accessibility; and develop resources through international collaboration
9.	WCAG 1.0 and 2.0	Web Content Accessibility Guidelines Formulated by World Wide Web Consortium in 2004 for standard of evaluating website contents
10.	Web Site	a group of World Wide Web pages usually containing hyperlinks to each other and made available online by an individual, company, educational institution, government, or organization
11.	URL	Abbreviation of Uniform Resource Locator (URL) it is the global address of documents and other resources on the World Wide Web.
12.	LISTA	Library, Information Science & Technology Abstracts™ (LISTA) is available FREE to any library - compliments of EBSCO Publishing. LISTA indexes more than 580 core journals, nearly 50 priority journals, and nearly 125 selective journals; plus books, research reports and proceedings.
13.	HCI	Human–Computer Interaction (HCI) involves the study, planning, design and uses of the interaction between people and computers. It is often regarded as the intersection of

	computer science, behavioral sciences, design and several other fields of study

1.10 Structure of the study

This study is organized into five chapters with preliminaries, appendices, and reference. Chapter one presents an overview and introduction to library website evaluation, web usability, web accessibility, methods of website evaluation, international standards etc. This chapter also portrays background, theoretical framework, problem statement, research objectives and questions, rationale and scope of the study including definitional terms.

Chapter two covers a comprehensive literature review in three major sections. Section one covers literature searching and screening criteria; Section two deals with critical review of i) literature on library website evaluation ii) usability studies of library websites, iii) accessibility studies of library websites, and iv) core literature on usability and accessibility studies of library websites. Section three presents summary and conclusion of the chapter.

Chapter three explains the deployed research methodology detailing about sources of information, population, sample size, data collection method, developing checklist based on international standards, rating scales for usability and accessibility evaluation of library website, selection of Web Accessibility Evaluation Tools (WAETs), and choosing expert evaluators.

Chapter four presents analysis, findings of the study, and discussion. This chapter interprets the data in two segments i.e. usability and accessibility. The chapter also discusses results of each website with reference to required international standard.

Chapter five concludes the research findings besides offering recommendations and suggestions.

2. LITERATURE REVIEW

2.1 Introduction

Keeping in view the widespread area of library websites studies as a whole, review of relevant literature was conducted for this study. Initial search of available literature on library websites revealed that a considerable amount of research work has already been done by the librarians and IT professional worldwide. However, these studies are diverse in nature, scope and objectives. Therefore, a systematic approach was adapted to identifying different types of studies i.e. defining criteria and benchmarking of library websites, evaluation and assessment studies, accessibility and usability studies, More than 50% articles were deselected after reading its abstract where it was found that:

- article's central theme is not library website but the study uses library website for examining catalog, library database, or web interface of digital library;
- articles' objectives is to experiment, compare, analyze the evaluation methodologies i.e. think-aloud protocol, card sorting, focus groups etc.;
- article is examining library blog not website.

2.1.1 Data Collection

Major online academic databases were searched to identify literature on library website studies. Then after citation of articles were consulted to make sure that the whole literature is covered. Finally electronic version of Abstracting and Citation databases of library literature was consulted to establish a well-defined landscape of literature on library website research studies.

2.1.2 Choosing Academic Repositories

The major online source of library literature is well-known Library & Information Science Technology Abstract (LISTA), available through http://www.libraryresearch.com.

However, because website evaluation studies have been the focus of emerging Human-Computer Interaction (HCI) research(S. M. Z. Ahmed, C. McKnight, & C. Oppenheim, 2009), therefore, top HCI journals and conferences were also taken into consideration for literature search. The articles related to library website were primarily identified using LISTA. Subsequently, we have queried other academic, research repositories and indexing databases like Google Scholar, EBSCO, SpringerLink, Project MUSE, Emerald, Taylor & Francis, ScienceDirect, Association for Computing Machinery (ACM) Digital Library, and Institute of Electrical and Electronics Engineers (IEEE) for possible existence of relevant articles for this study.

2.1.3 Searching

To identify research literature within the chosen outlets, an open search was executed with key words *library* AND *website* OR *website* on chosen academic databases. Moreover, all types of academic and research studies were considered for initial search including journal articles, conference papers, excerpts, reviews, etc. to understand and overview the depth of available research on library websites. Initial search on different databases identified 3073 articles from nine major databases, listed in Table-3.

Table 3
Number of Articles found in Online Databases

S.No	Database	Available through	Number of Articles retrieved
1.	LISTA	http://web.ebscohost.com	600
2.	Google Scholar	http://scholar.google.com	249
3.	SpringerLink	http://link.springer.com/	267
4.	Project Muse	http://muse.jhu.edu/	230
5.	Emerald	http://www.emeraldinsight.com/	53
6.	Taylor & Francis	http://www.tandfonline.com/	656
7.	ScienceDirect	http://www.sciencedirect.com/	840
8.	ACM Digital	http://dl.acm.org/	12

	Library		
9.	IEEE	http://ieeexplore.ieee.org/	166
		TOTAL	3073

2.1.4 Screening Criteria

Excessive literature was found on library and website studies in the initial search. However, bird's-eye view on collected list of research studies revealed that most of the articles were those covering library and website discretely and were not addressing the theme of "Library" and "Web Site" jointly. For the reason, a structured approach for screening of the articles was adopted by the researcher as under:

Step 1: All titles along with abstracts were copied and added in electronic worksheet using Microsoft Excel 2010 version.

Step2: After removing duplication, using spreadsheet formula, remaining 2145 articles were sorted alphabetically.

Step 3: To classify the relevant literature on library websites, a spreadsheet formula was again used to identifying those articles which have the words "library" AND "website" OR "website" in their titles, keywords, and/or abstracts. By doing so, 1546 articles were chosen for further processing.

Remaining articles were screened to see if they adequately focus the library website by reading their abstracts and deciding whether to include or exclude them or otherwise. The aim was to include only those articles which focuses library website as central theme and not those articles which study other issues adjoining the library websites. Secondly, cases related to the study of library blogs, library databases or an electronic database' interface were also excluded because blogs, databases and electronic interface does not fulfill the need and requirements of an individual and complete website.

Finally, 548 articles were selected for general review after necessary screening as explained above. Only articles written in English or available in English language were included because it was difficult to interpret the abstracts written in other languages. Later on, some articles of other languages were added for review whose English versions were found on the web.

This chapter is presented in four sub-sections covering literature on library websites into four sections from general to specific. Section 2.2 identifies and reviews literature on library website evaluation, assessments and analyses studies conducted so far. Section 2.3 pertains to usability studies of library websites while section 2.4 gives an overview of accessibility studies of library websites. Section 2.5 evaluates the core literature covering both the usability and accessibility issues of library websites together.

2.2 Literature on Library Website Research

Comprehensive review of library websites studies were taken as cases for evaluation. Abstracts of the selected studies were examined for purpose and objectives, type of library website study, and topical coverage in order to reach final conclusion about what has already been done on the topic of library websites.

France, Nowell, Fox, Saad and Zhao (1999) termed library users as ‘the chronic beginners’; this, he says, because of their “uneven demand for library services”, which resulted in passionate research separated by long gaps between the different issues to be resolved.

With respect to libraries, Spivey (2000) discusses the issues like how library professionals should communicate on the Web with their users and people outside the profession. Especially with those who may have diverse cultural background and little exposure to academic information seeking.

2.2.1 Number of publications on library website studies

Analysis of the data for literature review shows that interest in the research studies on Library website has drastically increased since 2006 onward. Year-wise distribution of articles reveal that 186 articles were produced in a span of 5 years i.e. from 2006-2010 while 111 articles have been published from 2011 to 2013. This increase in number of publications is due to increase in Internet users throughout the world. Projected number of articles on library website studies in the coming two years i.e. 2014-15 would be equal to the articles produced in 2006 to 2010.Yearly, an average of thirty seven articles have been produced on library websites from 2006 onward.

Large number of research studies is focusing the Academic library websites. Breakdown was necessary to classify which Academic library website is focused in maximum length. Further analysis of Academic library websites studies discovered that 18% articles are written on School library websites; 14% articles are focusing College library websites; and 68% studies covering the University library websites.

Broadly classified, articles on library website studies can be grouped into three categories i.e. Assessments & Evaluation, Benchmarking, and Other Studies. Coding book was used to code each article then percentage was calculated for each category. Coding process was monitored by authors and expert opinion of the IT professional was also sought.Result shows that 73% articles are on conducting different types of evaluations and assessments of library websites (Khan & Idrees, 2014). These studies present usability tests and analysis, accessibility evaluations, structural analysis, evaluating designs, resources, services, technology, and contents of library websites. About 24% articles on library website is focusing on Benchmarking includes articles related to developing checklist, identifying indicators, devising conformance to different standards, presenting models, analyzing and presenting case studies of design and redesigning of

library websites and suggesting different measures for face-lifting and/or developing library websites.

Beside above-mentioned, the remaining 3% literature is focusing other issues like marketing and advertising, applying best practices, instructional resources, informational & research material, biographical studies, copyright concerns, subject classifications, etc.

Considering the topic of the present study, the review of literature is limited to the literature regarding library website evaluation studies with special reference to usability and accessibility issues.

2.3 Library Website Evaluation Studies

The literature on library websites evaluation includes studies on contents, usability, accessibility, effectiveness in general. Early articles typically focused on design characteristics, because websites initially were supposed to provide information onthe available services and collections of the university's physical library.

Late in 1990s, technological developments along with digitization of library material opened new avenues for websites. The emergence of commercial databases, digital libraries, electronic journals, virtual and eBook repositories offered new contents and services on library websites which eventually facilitated research efforts also. During this period, library research faced a diverse change its nature and considered many new aspects of library website evaluation like navigation, searching, and usability.

As stated earlier, one of the first general evaluative studies of academic library website was conducted by Stover and Zink in 1996.Similarly, Clyde (1996) conducted one of the earliest evaluations of public library and school library home pages, using a random sample of 50 public libraries and 50 school libraries from 13 different countries. Librarians conducted early studies of

academic library websites based on the works of the first professional usability experts, such as Jakob Nielsen, Jeffery Rubin, and Jared M. Spool (Letnikova, 2003).

Early literature on librarywebsites includes studies on design characteristics where websites were merely used for providing information on collection and services. Later on with the emergence of Web 2.0 concept, the library website have seen paradigm shift in offering new opportunities for electronic services and user satisfaction.

Literature on library websites is multi-dimensional in approaches, methods, and objectives. Core literature on library website is mainly focused on improving the quality of library websites through evaluation studies.

Research study (conducted by the author of this work where around 537 articles on library websites were collected and analyzed) reveals that, in general, seventy percent of the library website studies are conducted on evaluation, assessments and analyses of different usability and accessibility issues (Khan & Idrees, 2014). Available literature on library website was closely examined to see which kinds of library website evaluations have been conducted so far by the researchers. Resultantly, library website evaluation studies have been further classified into four groups i.e. analysis of contents or Content Analysis (CA), analysis of usage of a website or Usage Analysis (UA), evaluation of the structure of website or Structure Analysis (SA), and Technology Analysis (TA). Webometric studies are based on these four types of analysis i.e. Content Analysis, Usage Analysis, Structure Analysis, and Technology Analysis (S. Z. Ahmed, C. McKnight, & C. Oppenheim, 2009).

Madhusudhan and Nagabhushanam (2012) present the status of usage of web by university libraries in India. Examining the web-based services offered by university libraries via their websites, this study presents librarians' perspective on how the web-based services be provided to their patrons in more efficient way. Findings show that surveyed universities are

lagging behind in effective use of their library websites. The study recommends effective use of Web 2.0, semantic technologies, ontologies, next-generation networking protocols, and multilingual support for contents for library websites.

George (2005) conducted a case study which include different usability studies used during the redesign phase by the Carnegie Mellon University Libraries. These libraries used web-based survey to assess needs of their patrons by presenting prototype design of the website. Think-aloud protocol method was also used as an alternative for this study while findings concludes that such protocol identifies several weaknesses regarding navigation, labeling and screen design. However, because this study is a case study, therefore the findings do not necessarily represent the general population of library websites.

Norlina (2002) writescomprehensively on the subject of library Web site design, its ease of navigation, and maintenance requirements. She describes that Usability testing, originally a marketing term, is used for four goals i.e. effectiveness, usefulness, user satisfaction, and learnability. Effectiveness and user satisfaction are evaluated for sites during usability testing programs. The author explores that usability helps to identify issues of necessary facets in the developmental stages of a library website.

In Pakistan, the library literature shows only four studies regarding evaluation of library websites with different purposes and objectives. These studies were conducted concerning evaluation of individual library website, analysis of web OPAC feature, content analysis of library websites, and web-based services in university libraries. These studies, however, used the same methodology with different approaches i.e. questionnaire survey, case-study method, and comparing item check-list based on previously conducted research work in other countries. These studies are further elaborated in section 2.4.

Unquestionably, it is concluded by initial search and review of literature that usability issue has been acornerstone for researchers during evaluation of library websites.

2.4 Usability studies on library websites

The issue of usability has recently attracted the attention of many researchers in the area of human-computer interaction and there is a vast amount of literature examining usability from various perspectives. However, this section focuses on the usability studies of library websites worldwide in general, and with special reference to Pakistan.

Ebenezer (2003) conducted usability evaluation of the then recently launched South London and Maudsley NHS Trust library website. Numerous usability evaluation methods i.e. focus groups, system usability scale (SUS), questionnaire survey, heuristic evaluation, observation testing etc. were employed for content and design evaluation.Usability problems were discovered in two main areas: in the organisation of the site, and in the terminology used to refer to information services and sources.

Research by Poll (2007) illustrated two methods of usability evaluation of website i.e. the evaluation with user participation and the evaluation without user participation. The study discusses diverse scope of library website quality including contents and accessibility. Finding of the study concludes that criteria for evaluating the quality of library website can be summarized to into checking adequate language for users, clear structure, options for different user groups, up-to-date information, and short/concise information.

Jiann-Cherng and Chih-Feng(2009) conducted a usability evaluation study on library websites of a university. Researchers used different methods like usability testing, system usability scale, and in-depth interviews to conduct his study. The study discusses its findings based on the participants' viewpoints collected before and after a redesign of subject library website. This study finds that usability evaluation can enhance user's experience and improves

user's satisfaction about library website. Similarly information architecture of library website also significantly influences user's satisfaction and experience. The study suggests that it is difficult to enhance the user experience by redesigning website without conducting appropriate usability testing because the university libraries experience the most frequently used functions and services so user satisfaction cannot be easily improved and enhanced. The study differs in presenting the experimental testing of modified library websites in order to measure the effectiveness of usability evaluation process.

King (2008) compared how the HHS the usability guidelines have been used in websites of various regions of the world. Researcher found that U.K and Irish websites obtained an average number of passes, while Indian and Pakistani websites had slightly more failed to comply with HHS guidelines than West Africa. It is argued that international standards developed in US or Europe aremore preferred in their own countries.

Mahmood (2008a) conducted a research study aiming to analyze features and functions of web-based catalogs of different libraries including academic, special and national libraries of Pakistan. This study, however, is not a usability study but provides insight into library online catalog, its features, functions, and requirements. Based on 91-item checklist developed with the help of previousstudies conducted in other countries, this study assessed 16 Online Public Access Catalogs (OPACs) and concludes that Web-OPACs in Pakistan are at initial stage of development and offers only basic features. Web-OPACs are lacking MARC format and support to non-Roman script.

Letnikova (2008) attempted to develop a standard list of questions for usability testing for academic library website by collecting data from 22 case studies conducted by librarians in United States and Canada. Based on her research, the author suggested fourteen simple and brief questions as a standard for formal usability testing of an academic library website.

VasanthaRaju and Harinarayana (2008) evaluated usability of design features of thirty library websites of top science universities worldwide. This study examines few specific features like navigability, user experience, multimedia features, color link behaviour, and link back to homepage of the studies websites. Researcher found that 53.33% of library website provides frequently ask questions (FAQs), 39.99% websites provide dedicated link back to homepage, 50% websites have persistent navigation features, and only 8% websites have de facto link color coding scheme. This study uses the usability guidelines suggested by National Cancer Institute.

Qutab and Mahmood (2009) surveyed the library website in Pakistan with a purpose to examine its contents. This study examined the contents and navigational strengths and weaknesses and to give recommendations for developing better websites and quality assessment studies. However, this study employed traditional methods of developing checklist on the basis of literature review and similar studies conducted worldwide, and did not considered any international standards while conducting content analysis process. The findings are no standard for content selection are considered for developing library website in Pakistan therefore, all library websites lack uniformity and miss important features.

Iqbal and Warraich (2012) conducted a usability evaluation of the Punjab University Library (PUL) website to ascertain the feelings of website users along with the efficiency of the system with reference to its goals and tasks. This work is a survey-based case study of the PUL website where 13 departments of the Punjab University were surveyed. Study concludes that PUL website satisfies two out of five affective and efficacy criteria.

With regards to library websites studies conducted in Pakistan, one of the recent study conducted by Mairaj (2013) where 17 university library websites were evaluated using survey questionnaire in both formats i.e. printed & electronic. Objectives of the study were to investigate level and purpose of use of university library websites. The study also explores and

examines the places used to connect the library websites and to find out relationship between use of internet and library website. The study concludes that university library websites are useful for patrons and that sufficient physical resource are available in the libraries to use their websites satisfactorily. Moreover, frequent use of internet enhances the use of library websites.

Walia and Gupta (2013) evaluated the usability features of the homepages of selected national libraries' websites of Asia with regard to their general features i.e. URL, window title, date and time, navigation, etc. with the help of checklist designed on the basis of guidelines given by Neilson and NIC (National Informative Centre). The study concludes that National Library of Japan is at rank number one among 23 national libraries of Asia and National Library of Maldives at the bottom rank.

Generally speaking, there are significant library website usability studies available worldwide. Most of the usability studies are conducted as a case study of an individual library website. Notable library website usability studies are Battleson et al. (2001); McGillis and Tom (2001); Susan (2001); Catherine (2002); Wegener, Moi and Li (2004); VandeCreek (2005); Roger and Preston (2009); Wijayaratne (2009); Anusha and Wijayaratne (2010) and Swanson and Green(2011)all evaluated the usability of individual library websites and presented case studies on usability evaluation.

2.5 Accessibility studies on library website

Accessibility evaluation is a multi-resource suite which outlines different approaches to evaluate websites in terms of accessibility of contents. The purpose of accessibility evaluation is to check the contents either through electronic or manual procedure that its accessible and are according to standard criteria as devised by Web Content Accessibility Guideline (WCAG)—International Standard. The methods and approaches provide general procedures and guidelines for evaluation of both under-developed and existing websites.

Research on library website Accessibility is relatively a new concept. Although there are significant researches done worldwide however, most of these studies have used automated tools for evaluation. Craven (2000) in his research article considers accessibility issues in terms of content provision; analyses current situation in UK academic libraries regarding provision of accessible library Web Pages. This work also discusses the policy, legislation and impact of web designers concerning accessibility issues.

Schmetzke, Axel (2001) conducted one of the early studies pertaining to concept of library programs for people with disability. The study describes "Americans with Disabilities Act (ADA) obligates that library programs and services must be accessible to people with disabilities". Findings of the study reflects a lack of awareness on accessibility issues where the study indicate that a large number of world's leading universities and library schools' webpages are not accessible. Study suggests that today information resides in digitalized form on WWW, therefore, ADA's mandate must be interpreted as applying not only to physical space but to cyberspace.

Providenti and Zai Iii (2007) discusses the guidelines, standards, legislation, and mechanism concerning web accessibility for academic library websites in the USA. Major findings are that public and private academic colleges and universities libraries do not provide accessible contents on their websites and they must comply with standard Section 504 as interpreted by the Department of Education's Office for Civil Rights, as well as Title II of the Americans with Disabilities Act.

Thompson, Burgstahler, Moore, Gunderson, and Hoyt (2007) found that "only few studies have used a manual evaluation method for greater detail and accuracy". Moreover, the study finds that Web Pages around the globe require improvement in terms of accessibility issues. Only fewer than half Web Pages receive pass criterion however, country-wise difference

in accessibility issues are significant. They argue that manual method was not given the sample size so use of Functional Accessibility Evaluator (developed by University of Illinois at Urbana-Champaign) is worthwhile.

Brobst (2009) assesses the home pages of Florida's public libraries for accessibility. This study includes every Florida public library system website, examining each home page of the 78 libraries offering websites. The study employed the WebXact online evaluation service to identify errors using compliance standards contained in Section 508 of the Rehabilitation Act of 1973. Findings reveal that 21 out of 78 public library webpages were found without accessibility errors which further indicate that 73% of websites had at least one major accessibility error based on Section 508 standard. Researcher further concludes that accessibility performance is related to library income level and income per service population.

Comeaux (2009) evaluated the accessibility of North American library and library school websites. This study is the follow-up of the previously conducted study and presents comparison between the data collected in 2006 with the data collected in 2000 and 2002. Findings show that the library and library school websites still contains accessibility barriers for many users with disabilities. However, the study concludes that redesign of library website has positive impact to address the accessibility issues more comprehensively.

Lazar, Jaeger, and Bertor (2010) in chapter 11 of the book discusses the accessibility issues in particular regarding use of library services. This wide-ranging volume tracking the use and involvement of public libraries with the Internet since 1994, offers both description and assessment. Author explores that during the year 2000 only 18.9% of popular public library websites' homepages in the United States were fully accessible.

Wijayaratne (2011) conducted research study on Sri Lankan academic libraries in order to measure the readiness of their website to assist people with any kind of disability. This survey

finds that provision of physical access, facilities, services, and provision of web access to people with special needs are far below the satisfactory level.

Kurt (2011) evaluates accessibility of Turkish universities' websites. The study is restricted to examine the homepage of the subject universities while concludes that homepages of studies universities have some accessibility issues. Results of the study indicates that all studied websites show multiple accessibility errors. The study also suggests measures to overcome the major accessibility issues found.

Conway (2011a) presents information on the Web Content Accessibility Guidelines (WCAG) formed under the Web Accessibility National Transition Strategy of Australian government. It is found that most of the public library websites do not follow WCAG and therefore, not easily accessible to people with visual, auditory, or cognitive impairments.

Fulton (2011) discusses web accessibility in accordance with the United States' federal laws. Additionally, this study describes about which states and up to what extent the web accessibility guidelines are mirrored. This study indicates that nearly 24.5 million people with disability lives in United States where a fewer states have adopted statutes of web accessibility referenced in Section 508 of the Rehabilitation Act or WCAG 1.0. Researcher suggests strongly that librarians must consult appropriate web accessibility resources in order to ensure their specialized contents accessible and reachable for all.

Another important research studyisConway, Brown, Hollier, and Nicholl (2012) which explores the website accessibility of the National Library of Australia and those of each of the nine State and Territory Libraries. She assessed the compliance of these websites with the Web Content Accessibility Guideline (WCAG) Version 2.0. She also offered background study of the introduction and implementation of WCAG 2.0 in Australia. Since the objective was to determine the accessibility of contents of websites for disabled persons, therefore, the study

revolve around different levels of WCAG version 2.0 only and no usability issues are taken into consideration in this study. Findings show that there is no compliance in Western Australian public libraries with WCAG 1.0 and 2.0 which requires considerable amount of work to be done to achieve this compliance.

Yi and Kang (2012) examines the accessibility issues of public library websites from the perspectives of PWDs. This study evaluates 20 public library websites, based on Section 508 of U.S Rehabilitation Act 1973, that have high percentage of PWDs and senior citizens. The findings indicate that public libraries did not consider their users or potential users with physical disabilities when designing their websites.

Research by Lazar et al. (2012) illustrated how public libraries in the U.S should take care of accessibility parameters. The chapter describes public libraries have been the equal provider of access to books, and both printed and electronic information, regardless of race, gender, religion, economic status, or disability. Further, elaborates that since the mid-1990s, public libraries have also been providing direct access to the Internet for patrons who come to visit.

Sohaib, Hussain, and Khan (2012) examines the relationship between web usability and web accessibility guidelines and presents the difference between both of them.

Hill (2013) vividly presented, how Library and Information Science (LIS), as a discipline, conceptualizing disability and accessibility? Hill argues that "*strongest theme in the literature is accessibility as it relates to web, database, and software, while the prevailing disability of focus is visual disabilities. The overall environment emphasizes technology more than attitudinal aspects associated with disabilities*".This study discusses about issues and trends in research regarding accessibility and disability in the library science literature throughout a 10-year period, 2000–2010.

Besides mentioned-above, there are several studies focusing on accessibility issues of library websites; finding that disabled people oftentimes do not have the same level of access to contents as their nondisabled peers. Flatley (2005) and Craven (2008)giving practical advice to LIS professionals regarding web accessibility about how to make their website accessible. Fan-Wen and Chien-Chieh (2009) explored web accessibility issues of library website in Taiwan and presenting markup language validation process. McHale (2011) described web accessibility evaluation tools and advised on what beginners should consider before conducting the web accessibility evaluation.Similarly, Green (2006), Coonin (2012) and Riley-Huff (2012), discussed the web accessibility for library websites using multiple approaches and concepts.

2.6 Core Literature on Library Website Evaluation

The aim of Usability is for the end-users to be able to learn and use a product to achieve their goals efficiently and with satisfaction. Accessibility has a similar concept whereas its purpose is that everyone should equally be benefited of design and contents of a website. Therefore, we design must consider both aspects of usability and accessibility during developmental as well as implementation phase.

This research, however, considers both the usability and accessibility issues of library website as defined by the international standards. Therefore, core literature pertains to the previous researchconsidering both usability and accessibility issues together.

The Web Accessibility Initiative (WAI) definition suggests that Accessibility is a sub-set of usability (i.e. that accessibility is only concerned with issues for a sub-set of users, being older and disabled people), whereas the ISO definition suggests that usability is a sub-set of accessibility (that accessibility is about issues for the largest possible range of users, including older and disabled people)

Snead, Bertot, Jaeger, and McClure (2005) discusses instruments created, tested, and operationalized for testing usability and accessibility by the researchers. This study demonstrates potential role of iterative evaluation strategies in development of digital libraries, needs assessments, methodologies of multiple evaluation approaches for assessments and evaluation of digital libraries.

Bertot, Snead, Jaeger, and McClure (2006) demonstrated an evolving effort for developing meaningful evaluations to assess digital libraries. Although, this paper is more concerned about digital libraries, however, it describes that usability and accessibility of is no exception in providing high quality services to users.

Dang and Chen (2007) describes usability evaluation of library websites using heuristic evaluation methods. The study found that usability evaluation plays a pivotal role to enhance quality of website contents and to better meet the needs of users.

Wijayaratne (2009) describes the key tools and techniques that are widely used for usability testing of Websites together with authors' experience in using them for the ongoing Website redesign project at the Open University of Sri Lanka library. Library websites have been evaluated in 4 dimensions i.e. accessibility, usability, content richness, and terminology. Results show that current status is not satisfactory since percentage of success is below 60% in all 4 dimensions. Besides, the current status of Sri Lanka, authors hope that the contents of this article will empower readers with tools and knowledge that can be used to perform successful Website redesign projects in their library environments.

Mukherjee (2011) assesses the usability and accessibility of popular commercial Indian websites using different web analyzer tools. Three popular Indian commercial website i.e. indiatimes.com, sify.com, and rediff.com were analyzed through Yahoo Site Explorer, Google Trends, Alexa and Smart viper. Findings were that rediff.com is more used among the three. The

study finds that there are differences between website designers' assumption about popularity of a page and audiences' actual interests. The study concludes that it may be meaningful to confirm audience interest during creation of web pages.

Apart from library websites, there are numerous studies e.g., Byerley and Chambers (2002); King et al. (2004); Steward, Narendra, and Schmetzke (2005); Jeng (2005) and Trivedi (2010) which evaluated the usability and accessibility issues of the library online catalogs, digital libraries, online library databases.

General experience is that usability can make all the difference between success or failure of a site, thus is crucial for QA. Despite the abundance of design recommendations (recipes, guidelines, etc.) website usability and accessibility continue to be pressing problems. Since focus of this study is to consider the library website and not the online databases, digital library or online catalogs therefore, these studies have not been evaluated in details.

2.7 Summary & Conclusion

Recently, the concept of usability has been extended to cover accessibility (Matera, Rizzo, & Carughi, 2006). In particular, Accessibility focuses on those application features that are supposed to be accessed universally by any segment of people and technology while usability means ease-of-use. Therefore, the usability and the accessibility are considered as a substantial facet for any website.

In particular,73% of the library website studies have focused the evaluation, assessments, examinations, and testing of website contents, structure, usage, design, services, resources, and technology for issues like usability and accessibility (Khan & Idrees, 2014). Some articles were on general design aspects of website contents, organization, elements, presentation of contents, and terminologies. Other studies include developing checklists, ascertaining guidelines, identifying criteria, marking evaluation indicators, devising standards, developing models,

conducting research-based designing/redesigning, describing processes of face-lifting of library websites. Multiple studies related to other issues like marketing and advertising, applying best practices, instructional resources, informational & research material, biographical studies, copyright concerns, subject classifications, etc. were also found in the literature review.

Research studies on library websites have increased gradually after 2006 onward. Academic libraries have been the axis of interest for researchers and 61% articles are focusing on academic library websites (Khan & Idrees, 2014). Among academic library websites, University library websites are broadly covered as compared to school and college library websites.

However, besides mentioned-above, there are other studies also related to evaluation of websites in different sectors, through different methods and for different purposes. With special reference to Pakistan, only four research articles have been found to evaluating the library websites for use, features and design components with different objectives. However, no accessibility study of library websites in Pakistan has been conducted before this study.

As long as findings of different studies on library website usability and accessibility are concerned, it can be summarized from literature that mostly library websites are suffering from lack of important accessible contents. Whereas, major issues concerning usability of library website contents have been evaluated keeping in view two different standards i.e. HHS and JISC. ISO 9241-151 is not been taken into consideration to evaluate library website which signifies the scope for this study.

3. RESEARCH METHODOLOGY

3.1 Introduction

This study is accomplished in four phases. In first phase, literature was searched and reviewed that helped the researcher to understand and comprehend the existing state of affairs on the topic in hand. In second phase, research instrument was developed and tested. In third phase, data was collected for both usability and accessibility issues. In fourth and final phase, data analysis and interpretation was done that led to compilation of this report.

3.1.1. Sources of Information

Collecting data and other relevant information for conducting a study is the most important step. The major source of information for this study were the contents of library websites situated in Pakistan, web content accessibility guideline documents, quantitative and qualitative data from stakeholders of subject websites, reports generated through automated website auditing tools, and expert evaluators. Moreover, telephonic conversation was also held in the process of data collection from the librarians and web developers of some websites.

3.1.2. Population

Population of the study is university library websites of Pakistan. According to a study conducted in 2009, there are 52 library websites in Pakistan (Qutab & Mahmood, 2009) out of which 45 belong to academic institutions. This information, however, require further updating as the number of universities and DAIs established in last few years. According to HEC's recently published official document (in March 2012) there are total 135 universities and degree awarding institutions in Pakistan.

3.1.3. Sample Size

This study intended to consider all university library websites of Pakistan in order to be able to generate comparison between the ratings of these websites. As a pilot study, the contents and structure of different university library websites were screened by accessing through their URLs. As a result, it was found that that mostly universities have not developed separate and complete websites for their libraries. Secondly, the existing websites are either just a part of university websites and that it only contains a single page and isnotproviding web services i.e. membership, online catalog, research and digital library through their websites.Finally, the library websites of top-ten Pakistani universities were selected as a sample for this study. The HEC ranking of universities include all types of universities of the country. Therefore, it is a true representative sample of different types of university library websites in Pakistan (i.e. general, medical, engineering and agriculture). Table 4 shows the list of top-ten Pakistani Universities as ranked by Higher Education Commission for the year 2013.

Table 4
List of top-ten Pakistani Universities as ranked by Higher Education Commission

Rank	Name of University	URL	Established	Abbreviation
1	Quaid-i-Azam University, Islamabad (QU)	http://www.qau.edu.pk	1965	QUL
2	Pakistan Institute of Engineering and Applied Sciences (PIEAS)	http://www.pieas.edu.pk	1967	PEAS
3	Aga Khan University, Karachi (AKU)	http://www.aku.edu	1985	AGA
4	University of Agriculture, Faisalabad (UAF)	http://www.uaf.edu.pk	1961	UAF
5	University of The Punjab, Lahore (PU)	http://www.pu.edu.pk	1882	PUL
6	National University of Sciences and Technology (NUST)	http://www.nust.edu.pk	1991	NUST
7	PirMehr Ali Shah Arid Agriculture University, Rawalpindi (UAAR)	http://www.uaar.edu.pk	1994	UAR
8	University of Health Sciences, Lahore (UHS)	http://www.uhs.edu.pk	2002	UHS

9	COMSATS Institute of Information Technology (CIIT), Islamabad	http://www.comsats.edu.pk	2000	CIIT
10	Lahore University of Management Sciences, Lahore (LUMS)	http://www.lums.edu.pk	1984	LUM

3.2 Developing Heuristics based on ISO 9241-151 guidelines

Guidelines are not easy to use for an expert review of whether a website complies with the guidelines. A more comprehensive checklist is required to test an application of compliance with a certain set of guidelines. A checklist that includes all requirements the application/website should adhere to. Checklist helps evaluators to check for compliance and keep track of the requirements that need to be met (Bevan & Spinhof, 2007).

Web user interface can be better judged against a set of internationally acceptable guidelines if structured in a verifiable and attainable checklist. For this reason, checklist contained in the official document of ISO 9241-151 was used with further explanation. Section 7 to 10 was taken into account for the checklist, because they are the only evaluable guidelines for an already developedwebsite. This is because sections 1 to 5 contain high level decisions and design strategies, so they will only be applicable to websites that are still in development but not for those that have already been developed.

Guidelines for evaluating usability have been divided into several groups according to the different sections of the ISO 9241-151, but with an exception: Section 8 has been divided into two parts, as in the ISO the aspects of navigation and search are put together in the same section, and it is preferable to evaluate separately the navigation and the search of the website. Therefore, sections that the template contained 5 groups that are as follows:

1. Content design: it is about everything related to the conceptual model of content, content objects and functionality.

2. Navigation: it deals with issues related to the structure and components of the navigation.
3. Search: it is about the aspects related to search terms on a web page.
4. Content presentation: it treats the aspects related to the design of a web page, links design, interaction objects and text design.
5. General design aspects: the guidelines of this group aim to be designed for a culturally diverse and multilingual use, and provide help and make web user interfaces error tolerant. In addition, it cares about the names of the URLs, the time of downloading, designing with independence of input devices, etc.

3.2.1 The ISO 9241-151 Standard Checklist

The checklist, contained in the ISO document is divided into 4 major Sections i.e. Content Design, Navigation and Search, Content Presentation, and General Design aspects. However, for ease of Evaluators, Section 8 (Navigation and Search) has been divided into two parts, therefore, total sections come to five. Total 133 checklist items were designed covering all the guidelines of international standards organization document.

To prepare an understandable and verifiable checklist, the guidelines mentioned in the ISO checklist were further explained with the help of two IT professionals having expertise in Web site Development.These guidelines were further explained using description available in the ISO document and examples were provided in the checklist with each item for concept clarity. The guidelines used in the checklist have been defined and explained in ISO standards in details, therefore, a copy of official ISO document also supplemented the checklist. Table 5 shows format of the checklist which was given to Evaluators.

Table 5
Structure of the Developed Checklist

Guideline Number	ISO guideline as contained in ISO	Explanation of guideline	Example	Space for score

	document		
7.2.5	*Making the date and time of the last update available*	*Ensure website shows the last updated date and time*	*Check if the last update date is given on the website or not*

Evaluators were asked to read each guideline carefully, check the entire website for compliance and give score accordingly.

3.3 Conducting Heuristic Evaluation

"In 2005, the Usability Professionals' Association (UPA) investigated all their members who are usability engineers to understand the most frequently used methods for conducting usability tests. The results showed that 70% of the evaluation process involves heuristic evaluation, usability testing, user studies, and interface/interaction designs" ("The Usability Professionals' Association," 2006).

The most popular type of expert evaluation is heuristic evaluation (Nielsen, 1994). Heuristic evaluation is a usability engineering method in which a small set of expert evaluators examine a user interface for design problems by judging its compliance with a set of recognized usability principles (the "heuristics"). Nielsen developed a set of ten widely adopted usability heuristics (Manzari & Trinidad-Christensen). After studying the use of individual evaluators as well as groups of varying sizes, Nielsen and Molich (1990) recommend using three to five evaluators for a heuristic evaluation. Multiple experts can identify more errors than a single expert, however, Nielsen argue that using more than five experts does not produce bigger results. Although heuristic evaluation can be carried out by people who are not trained in usability methods, better results are obtained by trained experts (Desurvire, et al., 1992)

Notwithstanding the fact that single individual is not able to identify all errors and usability problems, experience from different projects has shown that different people finds

different usability problems. Aitta, Kaleva and Kortelainen (2008), therefore, suggest effectiveness of the method could be significantly improve by involving multiple evaluators. Similarly, it is also argued by the usability experts that some usability problems are easy to find while some are found only by few evaluators. Moreover, rely on or identifying best evaluator is also not possible because it is not necessarily true that one person will be the best evaluator ever. Furthermore, some of the difficult usability problems can be overlooked by expert evaluators and are not always found by them; these are sometimes detected by less expert evaluators during the evaluation process. Therefore, it is necessary to involve multiple evaluators in any heuristic evaluation.

Nielsen (2001) stressed and recommended to use three to five evaluators since one does not gain that much additional information by using larger numbers.Similarly, Heuristic Evaluation is known to find more than 90% of usability problems if it's performed by 3 to 5 experienced people.[7]

In this study Heuristic evaluation was performed where each individual evaluator inspects the interface alone. Only after all evaluations have been completed, the evaluators met with each other in one session to communicate and have their findings aggregated. This session took place in the presence of the author in order to ensure independent and unbiased evaluations from eachevaluator. The results of the evaluation were recorded on given checklist duly signed by the evaluator along with their comments as an observer.

During the evaluation session, the evaluator goes through the interface several times and inspects the various dialogue elements and compares them with a list of recognized usability principles (the heuristics). In this study, Heuristics are ISO 9241-151 checklist contained in the

[7]http://www.sitepoint.com/heuristic-evaluation-guide

official document of ISO 9241-151 that describe international guidelines of usable World Wide Web user interfaces.

3.4 Choosing Expert Evaluators

In a heuristic evaluation, usability experts review a website interface and compare it against accepted usability principles. The analysis results in a list of potential usability issues.Five expert evaluators were selected among which three from library and information science being working librarians having sufficient knowledge of working with library websites and Web OPACs. Two experts from Information Technology and Computer Science having expertise in Web Development and or Web Site Management. The selection was made by devising the following criteria:

1. He/she should have sufficient qualification and expertise in the field of Information Technology
2. He/she should have sufficient educational background in the subject of computer science and/or library and information sciences
3. He/she should have minimum level of working with website development and under the basics of website evaluation process.
4. He/she should have sufficient cognitive values to under each heuristic and should demonstrate understanding the description of each heuristic without failing

Each evaluator was interviewed and given the checklist along with copy of the ISO 9241-151 Standard document to thoroughly examine each rule and report back with their level of understanding. Evaluators were required to examine each website according to given ISO Standard checklist (Appendix-1). Working sheet contained heuristics categorically as defined in the ISO document i.e. content design, navigation, search, presentation, and general design.

Keeping in view the above-mentioned criteria, five experts with a great deal of experience (3-5 years) in Library & Information Science, web designs, and sufficient knowledge of web interaction, were chosen (See Appendix-2 for biographical information of selected evaluators).

They were also asked to record suggestions concerning each heuristic, if possible. Each evaluator was given four days' time to bespent on each website working through the checklist. After their independent evaluation, a discussion was conducted with each evaluator to reach agreement on other usability problems that emerged from their evaluations.

Since ISO Standard Checklist is not self-explanatory, therefore, Evaluators were given a Heuristic Form (Appendix-3) a worksheet that include the ISO guideline in the first column and its explanation in the second column and identifiable check-item was given in the last column. Evaluators qualified their subjective judgments by assigning marks to specific item. The marks express in a 3-mark scale, indicating the degree of conformance with each particular rule. The range of assigned values was 0 (not applicable), 1 (not available), and 2 (available). And then the results were obtained as follows.

In principle, the evaluators should be given choice to decide on their own how they want to proceed with evaluation process. However, in accordance with general recommendation of usability experts, Evaluators were advised that they must examine the interface at least twice. The first pass would be intended to take an overview of the interface by interacting with general scope and option available—use the interface like a general first-time user. The second pass then would be intended to focus on elements of the interface and allows the evaluator to critically examine each of them in accordance with the given criteria.

Although evaluators (being representative users of this study) were all experienced computer and web users, their familiarity with basic library concepts varied greatly.Finding an

appropriate balance for evaluating the library website, evaluators from the field of LIS and IT were chosen in order to overcome their familiarity with LIS and IT concepts greatly.

3.5 Selecting WAETs

Web Accessibility Evaluation Tools (WAETs) are basically software programs or online web services used to examine the websites for detecting and reporting accessibility errors. These tools (describe by W3C) can significantly reduce the time and efforts during evaluation process. These are also used during design, implementation and maintenance phases of Web development. These tools, if used carefully, can assist in preventing accessibility barriers and offers repairing options, thus improving the overall quality of a website. The following are ways in which tools can assist users in evaluating Web sites for accessibility; some tools can perform:

- Determine the conformance of Web sites to accessibility checks which can be executed automatically;
- Effectively assist reviewers in performing accessibility checks which need to be evaluated manually.
- While determining the accessibility of different websites, these tools consider set of metrics for the evaluation purpose, those tools which have more features of repair having priority over other tools as they reduces the time and effort in maintenance of sites.

Two WEATs were used for data collection of accessibility issues. These tools were selected on the basis of performance, recommendation of previous research, and evaluation reviews in accordance with the methodologies described in the Web Accessibility Initiative (WAI) resource toolkit.

Multiple online Accessibility checking tools are available to check compliance to the standard of a website. Researchers and Designer use the output of these tools for improving the web content accessibility. These tools not only determine the level of accessibility, it also

provides support in maintenance and debugging/repair of the websites (Bakhsh & Mehmood, 2012).

In the website audit, two automated tools were used – SortSite[8] from PowerMapper, (PowerMapper software 2010) a commercial website checking tool, and FunctionalAccessibility Evaluator (FAE), a freeware application from the University of Illinois (University of Illinois 2005). SortSite is capable to evaluate the entire website with all web pages for hundreds of quality checkpoints on each page of a website. The SortSite requests pages from the web server in the same way that a web browser request them thus working with password protected pages and different server technologies like ASP.NET, JSP, ColdFusion, and SharePoint.

Evaluation Tools	Link/URL	Accessibility standards
Functional Accessibility Evaluator 1.0.2 (FAE)	http://fae.cita.uiuc.edu/	Overall
SortSite	http://www.powermaper.com/products/sortsite/	Overall

These tools are freely available online and are capable to check the websites for accessibility issues in different categories i.e. Text equivalents, styling, navigation, HTML standards etc. These categories are not new for checking accessibility rather it gives the opportunity to draw conclusion that either examined websites are following the standard accessibility guidelines or not.

3.6 Collecting data for usability issues

Evaluators were given required documents and the checklist both in soft and hard format along with list of URLs of websites to be evaluated. Each evaluator accessed the website in two sessions i.e. during the first session, evaluators went through the complete website and checked

[8] SortSite - Web Site Testing Tool. (2014). Retrieved Feb 20, 2014, from http://www.powermapper.com/products/sortsite/index.htm

each and every link on the site. Necessary information was collected and recorded concerning the general usage and overview of the contents presented and seen. In the second session, website was examined in accordance with the given checklist and rating scale. Comments were also recorded where the evaluators seemed to describe their rating for specific items.

The given checklist (See Appendix-3) consist of a title (as appeared in the ISO document) in the first column; its explanation (obtained from the web developers) in the second column, and an example along with explanation (available from ISO document which sets out the statement that should be complied with) in the third column. Each guideline was carefully checked for compliance and score was given as under:

- 0 if guideline is not applicable to library website
- 1 if a guideline is not satisfied by the website or the option is not available
- 2 if a guideline is satisfied by the website or the option is available

Checklist proforma was signed and handed over to the researcher after completion. Score given by the evaluators was entered in a spreadsheet created for the purpose of aggregation and overall rating of the each website.

The spreadsheet (called electronic coding book), containing a separate table for each of the following groups, was designed to interpret results of the collected data.

Table 6
ISO Categories of Web User Interface Guidelines

Group	Guidelines related to:
Content design:	Update of contents, feedback mechanism, policy statement, control of media objects, conceptual model, content objects and functionality
Search:	Aspect concerning provision, description, relevancy, ordering/sorting, refining of search options in a website
Navigation:	Structure and different aspects of website navigation
Content presentation:	Ensuring description , title, new contents, visual and

	temporal status consistency, color, frames, layout of a webpage
General design aspects:	Guidelines related to language support, error messages, help, standardization, location etc. of a website

The data collection process took 28 days to complete where each evaluator spent two days on each website carefully examining the compliance of the applicable guidelines in different course of time. In the process all evaluators were successful to return the given checklist within stipulated time frame i.e. 25 days. The data collection process was carried out from October 19 to December 15, 2013. During this period evaluators were in contact with the researcher regarding progress and percentage of work done. Similarly evaluators constantly shared their data and findings through email while telephonic correspondences took place regarding clarity of guideline and/or example provided in the checklist.

3.7 Collecting data for Accessibility Issues

Data on accessibility issues of subject websites were collected using WEATs. For this purpose, two online freely available tools SortSite from PowerMapper and Functional Accessibility Evaluator (FAE) were used for analysis of web content accessibility of the selected library websites. Description of these tools have been given in Section 3.5 of this document.

The data collection process was completed in two sessions. First, SortSite (commercial web accessibility evaluation tool) was downloaded from its official website i.e. http://www.powermapper.com/download/sortsite/ and installed on personal laptop of the researcher. Executing accessibility test on SortSite is a simple procedure because its interface is user friendly and requires only URL of the subject website to be entered for testing. Using its desktop interface, each website was accessed necessary checks were applied. Once the URL is typed in followed by and execution command, the software opens website in its interface and

asks for level of test to be selected. Complete website site auditing option was selected for the test and the software executed accessibility compliance test on the entire website returning with identified errors and issues in six categories i.e. scripting errors, accessibility issues, compatibility issues, privacy issues, searching problems, compliance to W3C standards. SortSite identify usability issues also but automated auditing of usability was not considered in this study because detailed evaluation of usability issues has already been considered as a complete section this work.

In second session, Functional Accessibility Evaluator (FAE) was used to conduct accessibility test on the subject website. FAE has an online interface and can be accessed via http://fae.cita.uiuc.edu/. FAE requires a free user registration account which was created by the researcher with requisite information.URL of subject websites were entered in the given interface and "Include DHTML" option was checkedin order to execute in-depth evaluation of dynamic contents along with identification of scripting errors also.Diagnostic report was generated which have issues and warnings of each site, in order to examine either website conforms to the web accessibility standards or not. Report also identified warnings and failure in informational context regarding the problems and missing components respectively. Each report was saved using Microsoft Word 2010 version for detailed examining later on. However, at the first instance level of conforms and overall assessment of a website could be well established as per requirement of W3C standards. Notwithstanding the fact that FAE was used to validate the results of SortSite and to identify accessibility issues as much as possible, this tool also helped in identifying scripting errors in more detailed manner.

Expert opinion of the IT professional was sought during interpretation of technical terms of both reports i.e. SortSite and FAE in order to understand the conclusion and interpret the collected data.

The logic behind use of two different tools is to check the reliability of the results based on the similarities of these standards, which largely match each other and some tools cannot test standards like 2.0.

3.8 Rating Scale and Interpretation of Usability data

Usability data was analyzed using Likert 3-level scale developed for rating of each checklist item (heuristic) with possible values from 0 for guidelines not applicable, 1 dissatisfied to 2 satisfied. Microsoft Excel Worksheet was used to calculate the score of each website based on the following rating scale given in Section 3.6 above.

The score provided by each evaluator for all categories was summed up to get average score for each website. Collected data was entered from the evaluator's score cards into Microsoft Excel worksheet and category-wise average score was calculated using below-mentioned formula and overall score of each website was obtained. To get the final score of a website in percentage, the average score of a website is divided by raw score multiplied by 100.The following MS Excel formula was used in the worksheet to obtain final score for each website containing total marks obtained from 5 expert evaluators.

Formula = (A/B)*100 = Overall Score

Where:

A = Average Score = (average of score obtained by a website)

B = Raw Score = (sum of the score of applicable guidelines)

C = Overall Score = (A/B) x 100

Evaluators introduces values that deems appropriate to them while putting the values in coding book, we got percentage of compliance of the guidelines and returns results to draw conclusion. Results were evaluated/data was interpreted on the basis of category-wise calculation along with overall score/value of the website using bipolar scaling method, measuring either

guideline satisfied or not satisfied. The guidelines which are not applicable were omitted and were not counted in scoring.

The data was analyzed based on the following categories given by ISO:

1. Content Design; 2. Navigation; 3.Search; 4.Content Presentation; 5.General Design.

Average score of each category for each website was calculated using the above-mentioned formula and overall rating of a website was obtained for level of conformance to international standard regarding usability issues.

Websites were rated on the basis of minimum of number of usability problems and overall high score obtained from the evaluators. However, non-applicable guidelines were identified in common and communicated to Evaluators to achieve consistency in results.

3.9 Rating Scale and Interpretation of Accessibility data

Accessibility rating was developed on the basis of number of accessibility issues identified in each website. SortSite® Professional web accessibility checker tool was used for evaluation of subject websites entirely and to generate results assessing the issues of websites for compatibility, Search Engine Optimization issues and conformance to required standards. The evaluation version of SortSite® is limited to checking first 100 pages of website, therefore, required results are generated on percentage of web pages identified with issues concerning each criteria and is discussed in details below:

WCAG defines three priority levels A, AA, AAA where priority A describes that PWDs would find it impossible to use website contents. Therefore, a website must follow priority Alevel guidelines in order to make the web contents accessible to all kinds of people including PWDs.

Compliance to priority level AA helps removing the accessibility barriers and makes the web contents more accessible to users. Similarly, conformance to priority level AAA refers to

make the website more comfortable and easy to use by PWDs. However, these guidelines are not so important especially for the users of library websites.

Each website was evaluated for general errors and issues concerning Accessibility issues, Browser-specific compatibility issues, Search Engine guidelines violation and optimization best practices, Compliance to W3C standards.Results of this study were analyzed on the basis of minimum and maximum number of priority A level accessibility issues. List of identified Accessibility issues for each individual website were compiled using Microsoft Excel Workbook out of the reports generated by WAETs. Commonly identified issues were compiled out of consolidated list of Accessibility issues. Websites were rated keeping in view percentage of overall conformance to priority A level issues which are mandatory for a website to conform with in order to make their contents accessible to all kind of people.

4. ANALYSIS & DISCUSSION

4.1 Introduction/overview

Analysis of the collected data on usability and accessibility issues were separately done using two different tools. Data was collected through expert evaluators by visiting each website and examining the applicable heuristics in shape of checklist. The main categories of the websites i.e. Navigation and Orientation, Text Equivalents, Scripting, Styling and HTML standards were checked for accessibility issues. The subject websites were examined through online auditing tools for identification of errors and defects. Whereas comprehensive checklist based on ISO 9241-151 guidelines was used to obtain usability data for each website. Accessibility data was examined through WAET and usability data was examined and analyzed using electronic coding book built in Microsoft Excel 2010 version.

Based on methodology and choice of evaluators from two different fields of studies i.e. IT and LIS, greater emphasis is given to the library websites and its features during the evaluation process and results obtained were cross-checked accordingly.

4.2 Usability Rating of Library Websites

It appears that main usability issues have been correctly identified. The major usability issues involve five main areas i.e. content design, navigation, search, content presentation, and general design aspects.

General features of navigation, search, content presentation, and general design aspects (as defined by ISO) like minimizing horizontal scrolling, placing information consistently, basic and advanced search availability etc. were found satisfactory on the studied websites but privacy policy, describing search techniques, last update date, etc. were found missing on all websites.

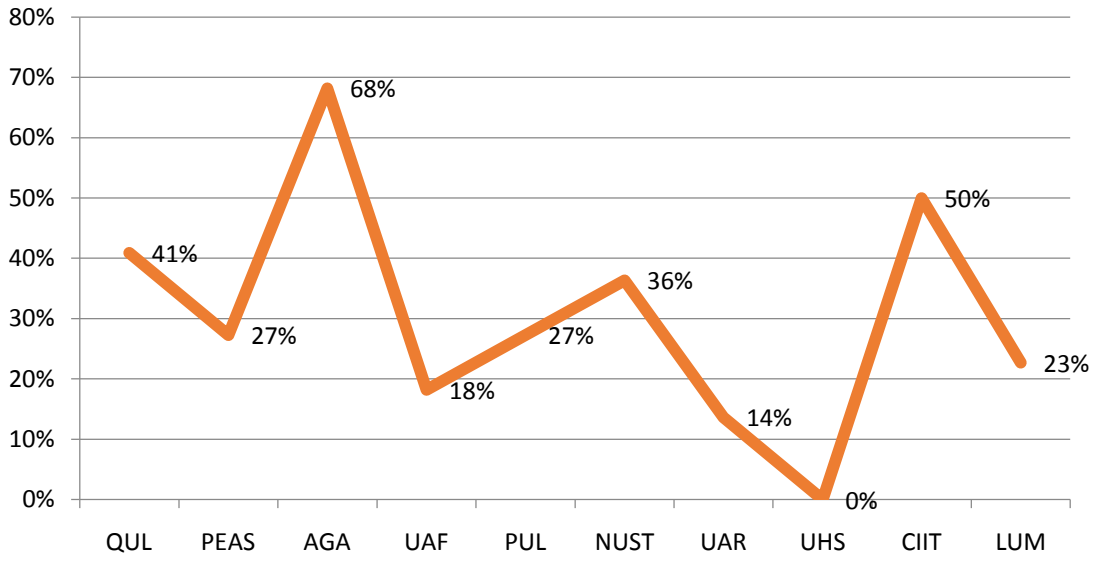
Absence of the categorization of contents with relevance (an important guideline) was also missing, leading to make it more confusing to access the relevant information quickly.

4.2.1 Content Design

Content design clause of the ISO standard is mainly concerned with appropriateness, updating, control, functionality, structure of website contents. Moreover, this clause is taking care of user's informational needs, user's adaptation, feedback mechanism, policy and privacy statement, and conceptual model of the website also. Checklist available in the ISO document is all about the above-mentioned issues that require compliance in order to enhance the usability of a website.

Content design is an important aspect of any website. Subject websites were thoroughly examined to check how many guidelines for Content Design are completely satisfied by each website. Analysis of the collected data shows that minimum level of compliance to guidelines regarding content design is only 14% (by UAR Library Website) while maximum level of compliance of these guidelines is 68% (by AGA Library Website). Figure 1 shows percentage of compliance to ISO guidelines on Content Design by the studied websites.

Figure 1. Compliance to Guidelines on "Content Design"



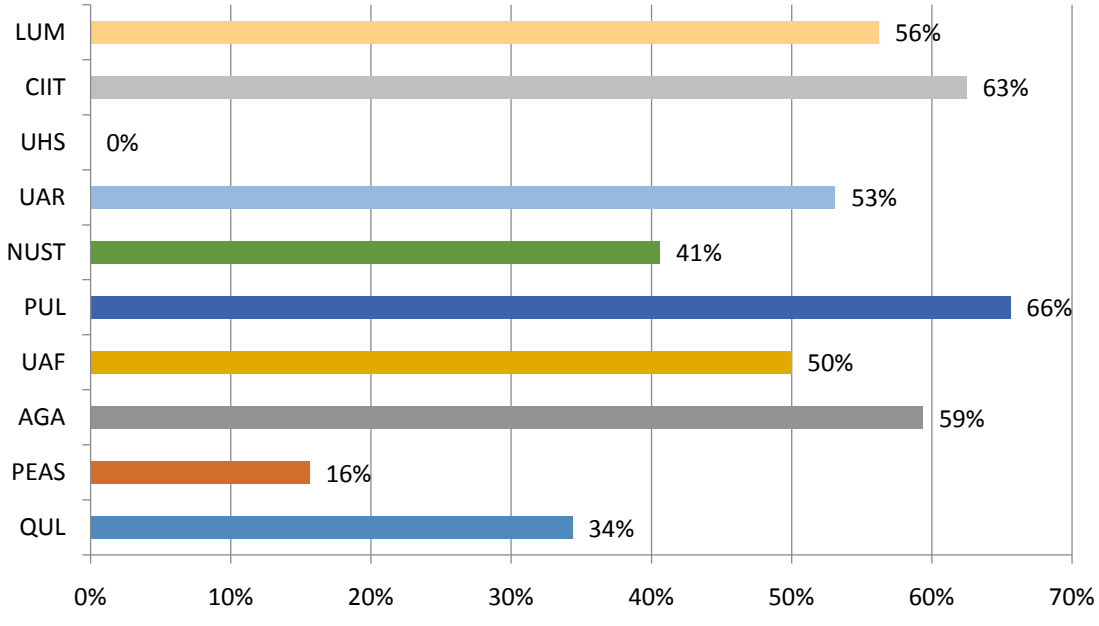
4.2.2 Navigation

ISO 9241-151 document defines Navigation as "Navigation involves the set of activities a user performs in a Web user interface to move from the currently visible (or otherwise perceivable) output of the system to another". International standards are more concerned to different aspects of website navigation like navigation structure, supporting users' navigation behaviour, user's current position in entire website, consistency of navigation components, incorrect and dead links etc. Therefore, this clause provides sufficient guidelines for a website and suggests 31 checklist items to be fully complied with.

As shown in Figure 2, the library website of University of the Punjab (PUL) satisfies 66% of the ISO guidelines whereas, CIIT is also in much better condition to comply with 63% guidelines. However, compliance of ISO guidelines in structuring an appropriate navigation for a website is not an easy task because there are certain ambiguous guidelines e.g. "*organizing*

navigation in a meaningful manner" which can be interpreted by the web developers in their own way and understandings.

Figure 2: Compliance to guidelines on "Navigation"



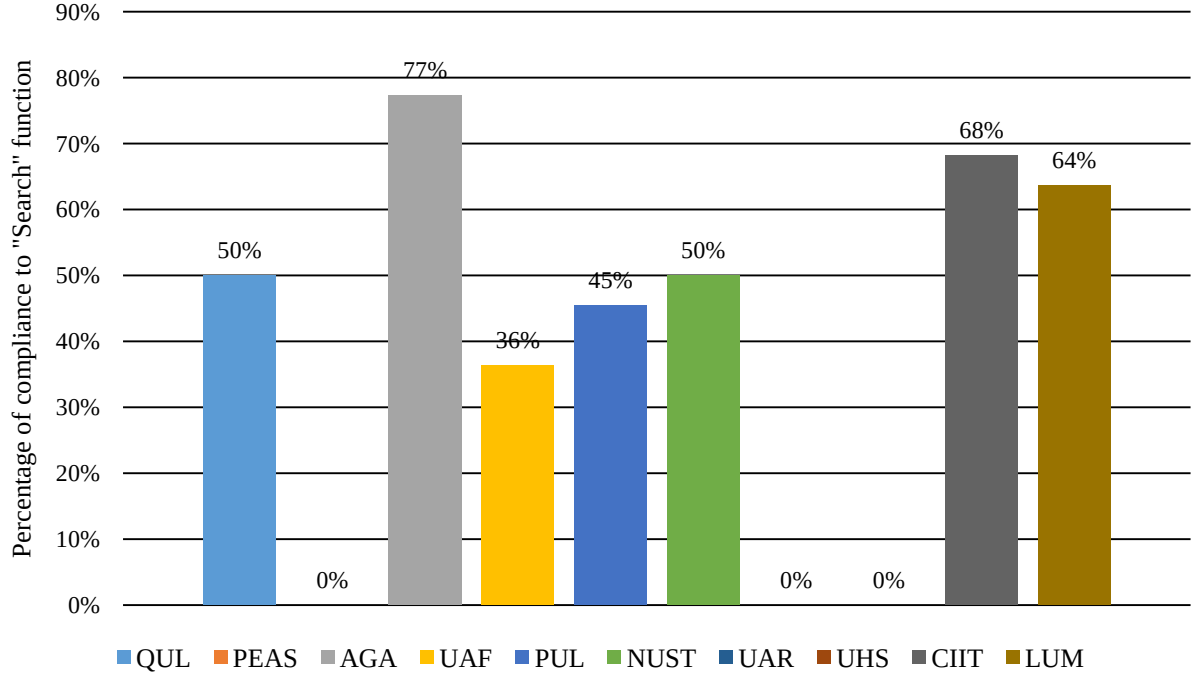
4.2.3 Search

Search is fundamentally an important task especially for library websites where the user is more concerned about searching and browsing reading material. Library websites are primarily accessed for informational needs therefore, guidelines of this particular clause have been given special consideration by the evaluators. Moreover, there are other studies available on evaluation of Online Public Access Catalogs of libraries like (Babu & o'Brien, 2000; Husain, 2003; Kapoor & Goyal, 2007; Kulkarni, 2003; Mahmood, 2008b; Mathias, 2003; Mi & Weng, 2013; Mirza & Mahmood, 2009). Although methodology and objectives differ from this study both logically and objectively, rather features related to library catalogs were not evaluated in details because it was beyond the scope of this study. It's worthwhile to mention that the importance of Searching and Browsing features of a library website cannot be overlooked.

There are 22 guidelines provided by the ISO in order to measure a websites' searching functionality regarding "Provision of Search Function" to the option of "Refining Search". As described by the ISO document, "Search functions offer direct access to the content…"

During data analysis it was found that most of the studied websites either does not provide appropriate Search function or the Search functionality do not comply with ISO standards. Only a few websites provide better and standardized Searching functions whereas 3 websites out of 10 do not offer any search option on their websites. The library website of Aga Khan University is found to offer good searching functions and satisfied almost 72% of the ISO guidelines. It was also found during the evaluation that most of these top-ranked universities do not provide their library's online catalog—whileinternational standards stresses in providing both the "website entire searching" and "catalog searching" separately.Figure 3 shows the overall status of websites to comply with ISO guidelines in providing standardized Searching functionality.

Figure 3: Compliance to Guidelines on "Search" function

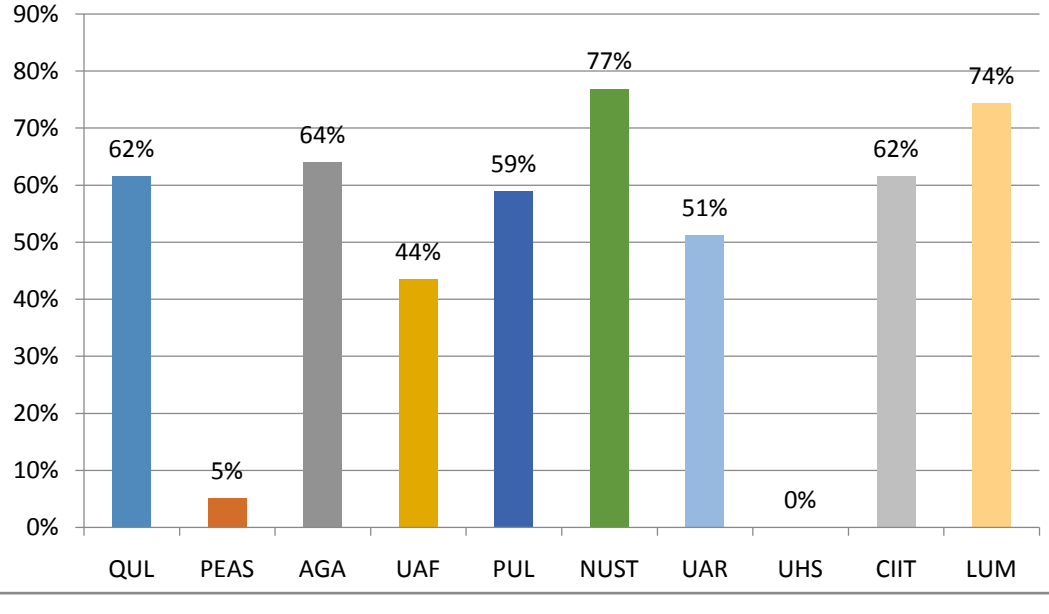


4.2.4 Content Presentation

This clause is mainly concerned with the guidelines on the presentation of contents in a website. It covers many aspects like ensuring description,proper title, identification of new contents, visual and temporal status consistency, color, frames. Other issues regarding page, link, and text design issues, along with interacting with objects in a website are also addressed here in this clause.

There are 41 important guidelines provided in the ISO document in this clause and all of them are included in the checklist. As shown in Figure 4, the maximum score in this particular clause of ISO guidelines has been obtained by the library website of NUST which is 77% followed by the LUMS library website. It means that these two library websites are presenting their contents more consistently and in accordance with the ISO standard. Remaining websites fall in between 5% to 64% compliance level.

Figure 4. Compliance to Guidelines on "Content Presentation"



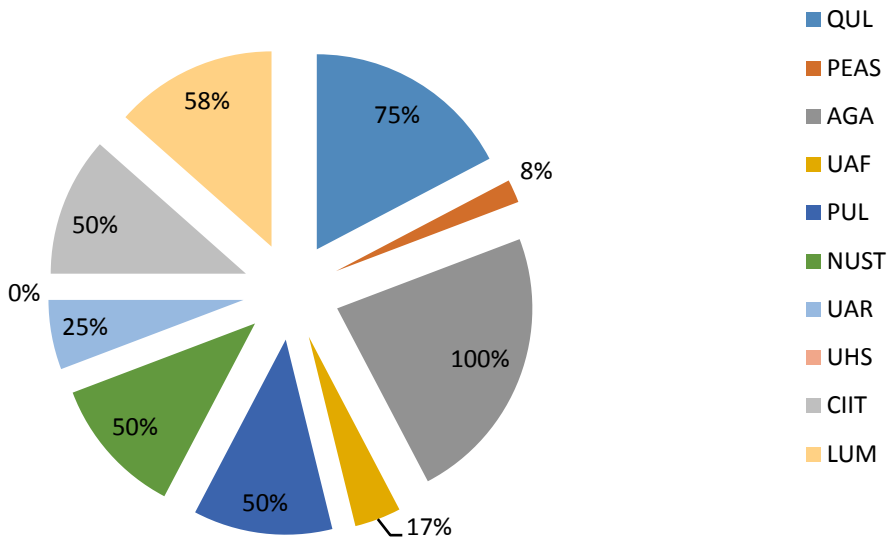
4.2.5 General Design aspects

This clause deals with certain guidelines that a website should provide language support, appropriate and understandable error messages, identify location where the website belongs, provide sufficient help in use of website, memorable URL names, acceptable download time etc. This clause also covers issues of device independence access to website for example a user should be able to use the website without a pointing device i.e. mouse. Similarly a website should support commonly used technologies also.

Notwithstanding the fact that evaluating websites for compliance to these guidelines was not an easy task because different tests were required to examine whether a website is developed in acceptable technology or a website display understandable error message if a user executes a wrong command. Similarly, validating "*device independence access*" to website and identifying "*provision of supported language*" was also not an easy task to be performed. For this reason, the Evaluators were guided for certain steps for example to access the website without mouse, check a website using online validation tools to verify that its built-up using acceptable technologies etc.

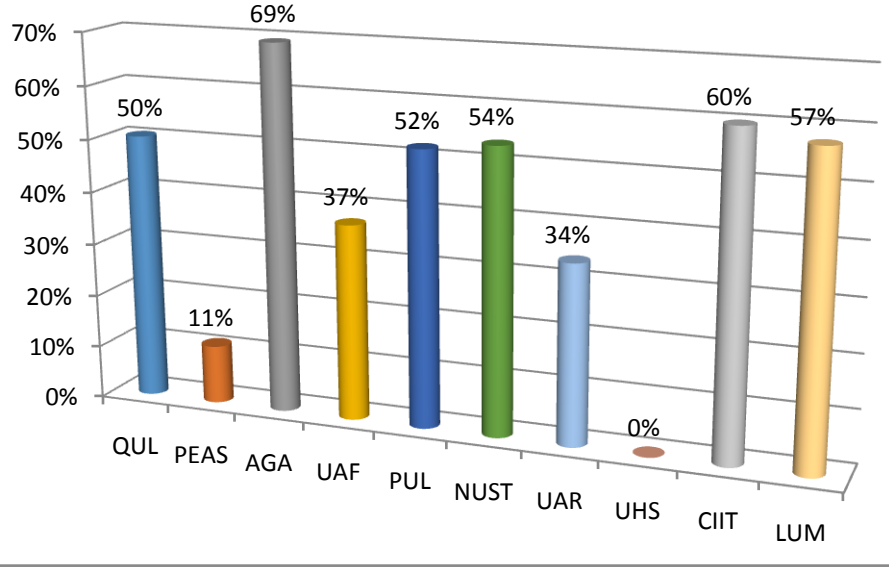
There are 14 guidelines provided by ISO in this clause. Analysis shows that the QUL website has passed 83% of the ISO guidelines while remaining websites could pass from 50% to 60% of the said guidelines (See Figure 5).

Figure 5. Compliance to Guidelines on "General Design aspects"



Usability analysis revealed that library websites in Pakistan require more considerable and thorough attention from the developers' perspectives, in order to make the website more users friendly and usable. Figure 6 presents the overall results of compliance to ISO guidelines by the studied websites. Considering overall ISO guidelines, the maximum compliance is observed at the rate 65% as shown in Figure 6.

Figure 6. Compliance to overall ISO guidelines by the web sites of top-ten Pakistani universities



Thus, there is considerable work to be done if they are to conform to international standards in usability issues

4.3 Accessibility Rating of Library Websites

The purpose of having a website that meets accessibility guidelines is to enable as many people as possible to use it easily and more effectively (Conway 2011).

Each website was evaluated for general errors and issues concerning Accessibility issues, Browser-specific compatibility issues, Search Engine guidelines violation and optimization best practices, Compliance to W3C standards.

Ascertaining the contents of subject websites through SortSite and FAE, it was found that 70 percent of the websites have multiple Priority A level Accessibility issues. The rest of 30 percent websites are in much better condition regarding scripting errors and browser compatibility issues. However, there were Priority AA and AAA level issues in almost all studied websites.

Categorically it is found from the results of data analysis that most common accessibility issues are blinking content without a mechanism to pause, Incorrect marking up table headers, Links that are not visually evident without color vision, No alternate attribute for image, No alternate for pointing device (mouse) input method, No alternate text for images, and Web page without title or meaningful title. Detailed discussion on each category is given hereunder:

4.3.1 Errors& Compatibility Issues

Multiple errors like broken links, scripting errors, server configuration, spelling mistakes, and dead links on the web pages of the understudy websites were identified by the tool. Overall 70 percent of the studied websites were identified with broken or dead links and spelling mistakes on their web pages. However, we have attempted to verify the results manually and

found that spelling mistakes (as identified by the SortSite) are either library jargons or proper nouns. While checking the compatibility of subject websites, it was found that only 10 percent of them have browser-specific compatibility issues. Collectively 13 pages out of 1000 were identified with missing contents or functionality issues for some browsers, whereas 43 pages were identified with major compatibility problems.

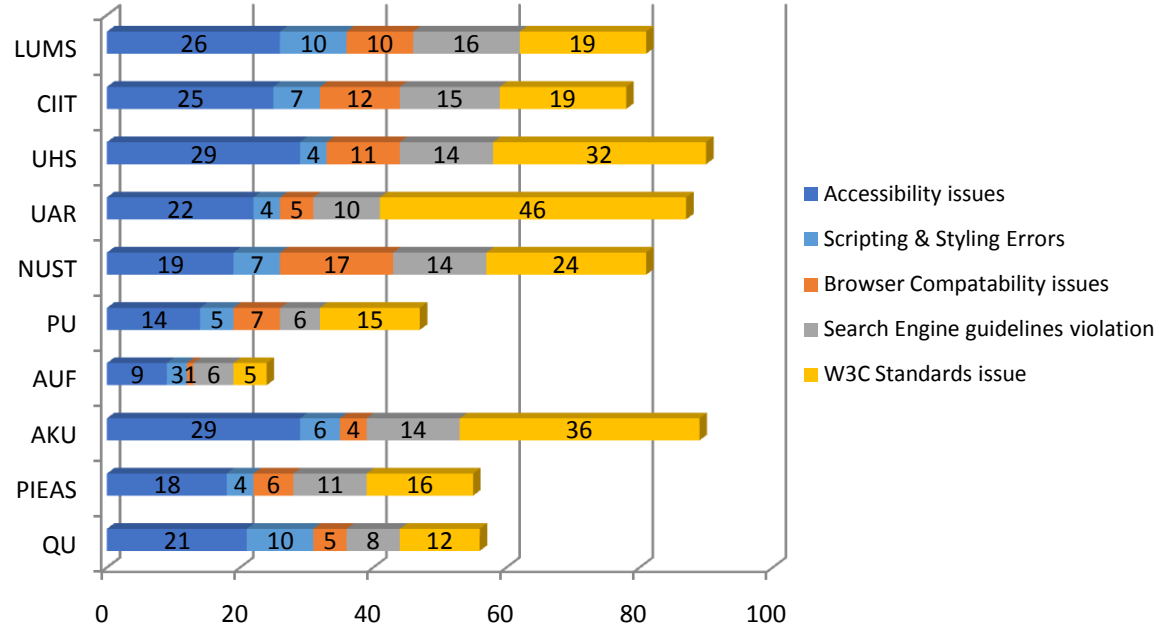
4.3.2 Search Engine Optimization

The notable result of this study is that 70 percent of the studied websites are better than average and no issues were identified regarding violation of SEO guidelines. However, our research tool has detected violation of SEO's best practice guidelines on the library websites of LUMS, COMSATS, and Quaid-i-Azam University.

4.3.3 W3C Standards

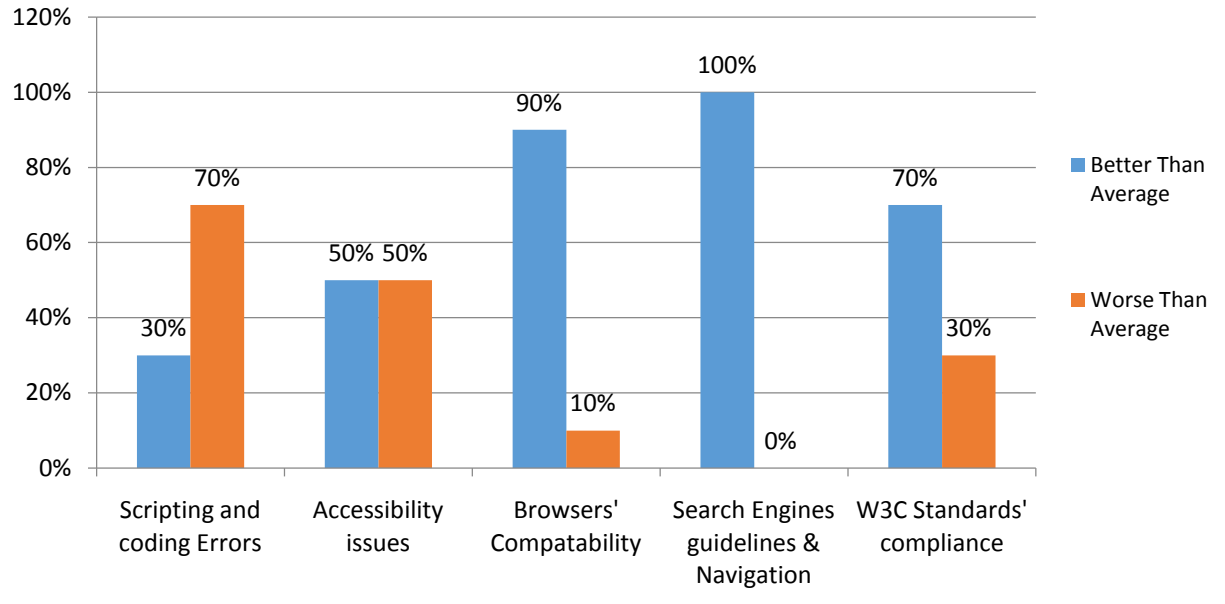
Thirty percent websites are found to have violating more than 50% of W3C guidelines and are placed in worse than average category. Multiple issues were also detected regarding W3C standards on the web pages of remaining 70 percent websites but they are found to have passed CSS and HTML validation which is the basic requirement for assessing W3C standards. Figure 7 shows the number of pages (in percentage) identified with accessibility issues. It is found that there are less number of pages identified in the library website of Agriculture University Faisalabad (AUF) while library websites of Agha Khan University and University of Health Sciences identified with multiple accessibility issues.

Figure 7. Number of pages/files of individual website with:



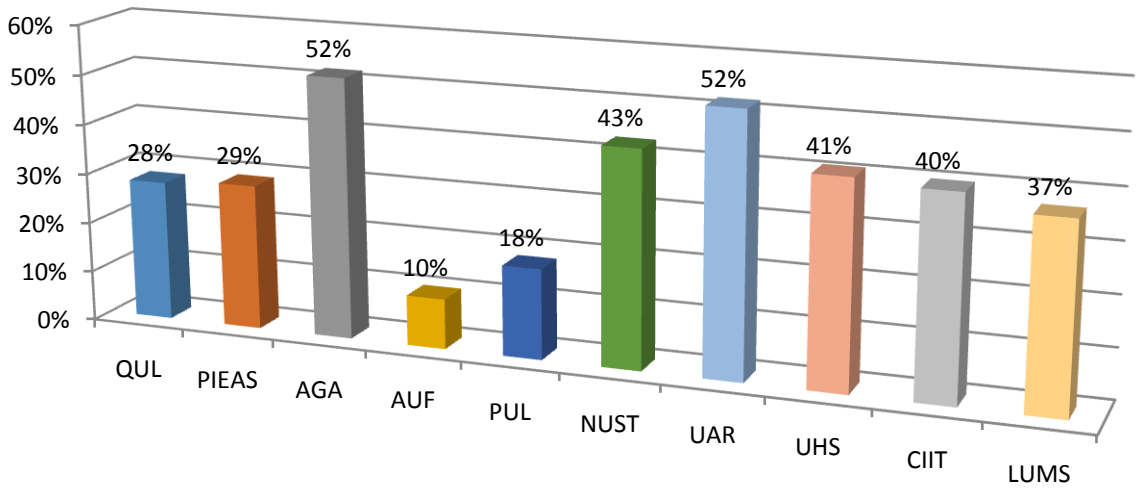
Collective analysis of subject websites was performed in order to judge the overall status regarding accessibility issues of library websites in Pakistan. Results of the analysis were summarized to explore how many websites are in *Better* and/or *Worse* condition. Figure 8 shows the collective analysis of all websites in percentage, based on the examined accessibility components. Analysis shows that major issue in the subject website is scripting and coding errors. The second one is the non-conformance to WCAG 2.0 guideline.

Figure 8. Component-wise Accessibility status of Library websites in Pakistan



Overall quality of website was judged by calculating number of pages with quality issues divided by total number of pages of a website examined by the evaluation tool. As shown in figure 9, the library website of Agriculture University Faisalabad (AUF) is found to have minimum Accessibility issues whereas the library website of The Aga Khan University (AGA) and University of Arid Agriculture (UAR) are found to have maximum number of Accessibility issues. SortSite identifies the number of web pages with overall quality issues after checking the entire website for over 450 quality issues.

Figure 9. Percentage of Web pages with Quality Issues



4.2.4 Commonly identified Accessibility Issues

Evaluated through WEATs, commonly identified Priority A level Accessibility issues in subject website are mentioned in Table 7. These issues have been found in all library websites studied in this research.

Table 7
Commonly identified Accessibility Issues

W3C Code	Heading	Description of the failure
F7	Blinking content without a mechanism to pause.	No provision to pause the blinking contents. The user may not have sufficient time to read the content between blinks or it may be so distracting that the user will not be able to read other content on the page
F77	Duplicate values of type ID	Duplicate values of type ID which makes user unable to programmatically determine which headers are associated with the data cell or which

		control is associated with which label or name
F91	Incorrect marking up table headers	Navigating cell by cell, screen readers will often fail to read the header cells associated with content.
F73	Links that are not visually evident without color vision	Non-color visual distinction is required for links because people who cannot perceive color differences cannot identify links
F65	No alternate attribute for image.	In this case assistive technologies are not able to identify the image or to convey its purpose to the user
F89	No alternate for pointing device input method	Users with special needs such as using alternate keyboards or input devices that works as keyboard emulators for the people with disability, will not be able to access the function of the content
F68	No alternate text for images.	Describes a failure condition where links contains only non-text content, for example an image, and/or the these non-text contents are implemented in a way that it can be ignored by assistive technology
F54	Using only pointing-device-specific event handlers (including gesture) for a function.	Pointing device is the only mechanism available to invoke a function of the content. In this case the users with no vision or user who want to use keyboards or input devices will be unable to access the function of the content
F25	Web page without title or meaningful title	Describes a malfunction situation where web page contains a title, but the given title does not identify the appropriate contents and/or purpose of the web page.

It is clear from the results obtained through WAETs and described above that seventy percent of the library websites meet Level A requirements of WCAG 2.0. It follows that PWDs would have no problem accessing material/information from these websites.

However, it should be reiterated that in order to meet Level AA requirements, library website developers and librarians must work to improve.

5. CONCLUSION & RECOMMENDATIONS

5.1 Introduction

This chapter presents a cumulative conclusion based on the findings of empirical data; collection of range of recommendations, based on this study and a review of literature, envisioned to assist developers and librarians in the creation, modification, and reengineering of more effective, accessible and usable library websites; and indication for further studies.

5.2 Findings

In a nutshell, findings of this study as grouped under each research question is presented below:

1. Do University Library Websites of Pakistan comply with international standards for web usability (Defined by ISO.)? Yes fifty percent of university library websites passes usability guidelines as defined by ISO 9241-151 standard.
2. What is the level of compliance of subject websites to the ISO 9241-151:2008 usability guidelines? University library websites in Pakistan comply with 50% to 69% of ISO 9241-151:2008 standard.
3. What are the accessibility issues of university library websites in Pakistan? Complete list of commonly identified Accessibility errors have been shown Section 4.2.4. Besides other Accessibility errors, mostly library websites are lacking in correct markup language, placing alternate text and attribute for images, and meaningful title of web pages.
4. What are the major shortcomings of University Library Websites in Pakistan to comply with ISO 9241-151:2008 guidelines? Major shortcomings of university library websites in Pakistan are improper content design, inaccurate navigational structure of the website,

unavailability of proper search facility, and lack of consistency in content presentation. Web developers in Pakistan must follow the instructions provided in ISO 9241-151 guidelines while developing library websites.

5.3 Discussion

Powlik and Karshmer (2002) argue that implementation of accessibility guidelines and using accessibility tools have done a lot in the same way that Braille signage, wheel chair ramps, and automatic doors have made buildings more accessible, but variously-abled users of the site may give a different opinion. It is, therefore, that involving users for evaluation of website has also same importance. Evaluating website for usability and accessibility issues is of core importance in order to make the website usable and accessible.

Website evaluation gives an insight for a usable and accessible web. A website having high usability and accessibility is useful for the Users and is profitable for the Owner of the website. Looking at user's perspective it is:

- speedy and stress-free to learn or navigate,
- well-organized to use (users can achieve goals quickly and with minimum effort/trouble),
- catering user errors and quick to recover (e.g., using fuzzy logic),
- stable in its fundamental structures and operating principles,
- enjoyable to use,
- aesthetically pleasing.

Looking at Owner's perspective it reduces:

- sales costs (if the site is easier to use, its service is easier to sell),
- production costs (usability data can be used to identifying unnecessary/inefficient procedures which can then be eliminated, simplifying the site),

- testing and QA costs (when usability testing is conducted on a site, problems are caught much earlierand quantifiable feedback can be given to future services)

The principal research question was addressed through the website audits which demonstrate emphatically that 40% library websites do conform to primary usability standards while 50% of library websites have serious accessibility issues.However, some major usability components are found missing in the studied websites which certainly affect their patrons to use it effectively.

Several suggestions have already been made by the researchers for a good library website. Naismith and Stein (1989) suggested that variety of strategies like provision of glossaries, use of explanatory phrasing, avoiding library jargons, etc. should be employed by LIS professionals in developing their library websites in order to bridge the gaps in understanding.

5.4 Conclusion

This study concludes that current status of library websites in Pakistan with respect to general usability issues, as required by ISO 9241-151:2008, is not very good. Most of the important guidelines are found violated by the studied website. As far as Accessibility issues of these website are concerned, it was found that most of the website conforms to basic accessibility criteria defined by WCAG 1.0 and 2.0. However, Priority level AA which requires that a website be easily accessible to people with disability (PWDs), and Priority level AAA which demands that PWDs would feel comfortable using the websites are yet to be met by these websites.

Collected data was analyzed to find either subject websites do comply with international standards of accessibility and usability or not. In a nutshell, it could be said that

- Fifty percent 50% of the library websites comply with priority A level guidelines of WCAG 2.0 as defined by W3C.

- Sixty percent 60% library websites passed the usability test and are found to satisfy 50% to 69% of the ISO 9241-151 requirements.

However, more importantly, the evaluation process brought a lot of insights, suggestions and comments towards designing a user-centered and more accessible library websites in Pakistan.

If concluded, we can say that Accessibility (which refers to the accessible contents of the website to all its patrons) half of the library websites in Pakistan do comply with international guidelines in a better way as compared to other developing countries. Usability, at the other hand, reveals that studied websites do not comply fully with the guidelines. Then it is concluded from the study that contents of these websites are readily accessible but are less usable for their users.

"Effective usability becomes also important for the design of web-based application. Therefore, it is important to follow and adopt suitable web design guidelines while keeping in view the usability challenges" (Sohaib, Hussain, Ismaili, et al., 2012).

Talking about the Usability issues evaluated according to ISO standards, the overall results are not satisfactory. Multiple issues like general web design, requirement for appropriate searching options, way of presentation of contents and overall structure of the library website is found to have not complied with the required international standards. More of the concluding remarks have been incorporated with recommendations.

5.5 Recommendations and Implications of the Study

Based on the results of this study, literature reviewof relevant research studies, and guidelines provided by International Standards, the recommendations are grouped together for improving website usability and to make the contents more accessible to a wide range of people.

In order to help enhance the usability of library websites in Pakistan, these must conform to the basic criteria devised by the ISO web usability standard.

Detailed analysis of each studied website demands separately formulated recommendations and suggestions. These are framed and will be communicated to each organization as per results of conformance to ISO standards. However, the very common problems (required for compliance with respect to usability standards) of all websites are discussed and suggestion/recommendations are given hereunder.

Followings are the recommendations/suggestions for all library websites regarding rectification of important usability issues found

- Making the date and time of last update available at their website so that users may not assume or be left with outdated information.
- Site map is always important for users to understand the overall structure of a website and find exact location of the needed information. No library website offers Site Map therefore, it is strongly suggested that library websites must offer a clear Site Map on their websites.
- Error-tolerant search is very much important guideline which provides an option to the user if a wrong search query is given. This means that when a misspelled word is given, the system presents both results of searching for the incorrect term as well as suggest searching again with corrected term. This option is found missing in all studied websites. It is, therefore, strongly suggested that each website must provide error-tolerant searching and should provide with an option explained above.
- Library websites are primarily supposed to have contained Library Catalog Search option, while ISO guideline demands (in 8.5.4.1 guideline) to specify Scope of a Search. If one search field is given at the library website, it must be made explicitly clear that

either the search field provided on the website offers searching the contents of website or is providing OPAC through the given search field.

- Color contrast is used to make the website links more visible. No studied website offers this visible color contrast, thus making their users confuse about previously visited contents. Each time a user visit the website, he/she is required to start from the scratch. This situation is no more tolerated in the advance environment which needs to be addressed in the library websites of Pakistan.
- No studied website is found to give advice for unsuccessful searching thus violating one of another important guideline of ISO.
- No studied website is found to offer HTML text-only homepage thus making it impossible for the users with low bandwidth of internet connectivity to access their websites easily. It is suggested that each library website must offer text-only pages also in order to make their patrons to access their website even if with low bandwidth internet connection.
- No studied website offers printable version of their website. Therefore, all user are left with option to read the contents on the screen. ISO guideline demands that each website must offer printable version so that users, who could not or do not want to read the contents on screen, should have an option to have its printed version.
- An important guideline i.e. 9.6.6. “Making text resizable by the user” says that website should offer an option to increase or decrease size of the text for ease of readability of users having low vision/eyesight or readability problems. This option is found missing in all studied website thus making in difficult for their patrons to read the text of the website easily. It is suggested that resizing of text within screen should be offered by the library websites. This is also considered major accessibility barrier of a website.

Besides above-mentioned general usability issues, there are several other important usability guidelines which are either partially or completely unsatisfied by some of these websites. Lists of important unsatisfied usability guidelines are created for each individual website for onwards submission to concerned library for rectification.

In general, there are some recommendations on design, structure, and general overview which may also be considered by the concerned authorities responsible for the development of library websites in Pakistan.

- LIS professionals must enhance their web-based interaction skills and take the initiative to provide them through their websites
- It is strongly recommended that LIS programs, schools and professional associations should create awareness about web usability and web accessibility issues along with training opportunities for LIS professionals in Pakistan.
- Awareness to accessibility and Usability among professional librarians is another factor for such situation as only two library schools are teaching web development courses as an optional subject in their master's curriculum (Qutab & Mahmood, 2009). Librarians also lacking web-based interaction techniques, where Mirza and Mahmood (2009) argue that there is an urgent need to develop dynamic websites with a direct hyperlink on the University websites' homepage. It is, therefore, strongly suggested that web development be made integral part of course curriculum at Master level courses in Pakistan.
- It is suggested that link to library website/page be highlighted in prominent color on the University's main website and a prominent link to OPAC should also be given separately.
- Some of the problems of navigation and search like scope, function, describing techniques for searching, ordering and ranking of search results, etc. can be easily resolved by the web developers of the concerned university.

- The library staff of each university's library must provide feedback to their web developers/designers regarding library website/webpage in order to be dynamic and responsive to users.
- Text/language of the website also made it difficult to make some points clearer when evaluators want to navigate without reading instruction. Evaluators suggested that having more notes to explain unfamiliar and similar terms like Journals and Index Database. However, if site is overloaded with too much explanation of library concepts, it could be annoying for advanced users. In this case, a separate page with glossary is a possible solution.

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APPENDICES

Appendix 1

ISO Standard Guidelines Checklist

ISO Code	**CATEGORY**	**Conformance**			
7	**CONTENT DESIGN**	Yes	Partially	No	Comments
7.1.2	Designing the conceptual model				
7.1.3	Appropriateness of content for the target group and tasks interface look and feel				
7.1.4	Completeness of content				
7.1.5	Structuring content appropriately				
7.1.6	Level of granularity				
7.2.2	Independence of content, structure and presentation				
7.2.3.1	Selecting appropriate media objects				
7.2.3.2	Providing text equivalents for non-text media objects				
7.2.3.3	Enabling users to control time-dependent media objects				
7.2.4	Keeping the content up to date				
7.2.5	Making the date and time of the last update available				
7.2.6	Enabling communication with the website owner				
7.2.7	Accepting online user feedback				
7.2.8.1	Providing a privacy policy statement				
7.2.8.2	Providing a business policy statement				
7.2.8.3	User control of personal information				
7.2.8.4	Storing information on the user's machine				
7.2.9.2	Taking account of the users' tasks and information needs				
7.2.9.3	Making individualization and adaptation evident				
7.2.9.4	Making user profiles evident				
7.2.9.5	Allowing users to see and change profiles				
7.2.9.6	Informing about automatically generated profiles				
7.2.9.7	Switching off automatic user adaptation				
7.2.9.8	Providing access to complete content				
8	**NAVIGATION**				
8.2.1	Making navigation self-descriptive				
8.2.2	Showing users where they are				
8.2.3	Supporting different navigation behaviours				
8.2.4	Offering alternative access paths				
8.2.5	Minimizing navigation effort				
8.3.2	Choosing suitable navigation structures				
8.3.3	Breadth versus depth of the navigation structure				
8.3.4	Organizing the navigation in a meaningful				

	manner				
8.3.5	Offering task-based navigation				
8.3.6	Offering clear navigation within multi-step tasks				
8.3.7	Combining different ways to organize navigation				
8.3.8	Informative home page				
8.3.9	Directly accessing relevant information from the home page				
8.3.10.1	Avoiding unnecessary splash screens				
8.3.10.2	Skipping splash screens				
8.3.11	Avoiding opening unnecessary windows				
8.4.2	Providing navigation overviews				
8.4.3	Maintaining visibility of navigation links				
8.4.4	Consistency between navigation components and content				
8.4.5	Placing navigation components consistently				
8.4.6	Making several levels of navigation visible				
8.4.7	Splitting up navigation overviews				
8.4.8	Providing a site map				
8.4.9	Providing cross linking to potentially relevant content				
8.4.10	Making dynamic navigation links obvious				
8.4.11	Linking back to the home page or landmark pages				
8.4.12	Going back to higher levels				
8.4.13	Providing a “step back” function				
8.4.14	Subdividing long pages				
8.4.15	Explicit activation				
8.4.16	Avoiding dead links				
8.4.17	Avoiding incorrect links				
	SEARCH				
8.5.2.1	Providing a search function				
8.5.2.2	Providing appropriate search functions				
8.5.2.3	Providing a simple search function				
8.5.2.4	Advanced search				
8.5.2.5	Full-text search				
8.5.2.6	Describing the search technique used				
8.5.2.7	Availability of search				
8.5.2.8	Search field size				
8.5.2.9	Shortcut to search function				
8.5.2.10	Error-tolerant search				
8.5.3.1	Ordering of search results				
8.5.3.2	Relevance-based ranking of search results				
8.5.3.3	Descriptiveness of results				
8.5.3.4	Sorting or filtering search results				
8.5.4.1	Scope of a search				
8.5.4.2	Selecting the scope of a search				
8.5.4.3	Providing feedback on the volume of the search result				
8.5.4.4	Handling large result sets				

8.5.4.5	Showing the query with the results				
8.5.5.1	Giving advice for unsuccessful searches				
8.5.5.2	Repeating searches				
8.5.5.3	Refining searches				
9	**CONTENT PRESENTATION**				
9.3.1	General page information				
9.3.2	Consistent page layout				
9.3.3	Placing title information consistently				
9.3.4	Recognising new content				
9.3.5	Visualising temporal status				
9.3.6	Selecting appropriate page lengths				
9.3.7	Minimise vertical scrolling				
9.3.8	Avoiding horizontal scrolling				
9.3.9	Using colour				
9.3.10	Using frames with care				
9.3.11	Providing alternatives to frame-based presentation				
9.3.12	Providing alternative text-only pages				
9.3.13	Consistency across related Web sites				
9.3.14	Using appropriate techniques for defining the layout of a page				
9.3.15	Identifying all pages of a Web site				
9.3.16	Providing printable document versions				
9.3.17	Use of “white space”				
9.4.2	Identification of links				
9.4.3	Distinguishing adjacent links from each other				
9.4.4	Distinguishing navigation links from transactions				
9.4.5	Self-explanatory link cues				
9.4.6	Using familiar terminology for navigation links				
9.4.7	Using descriptive link labels				
9.4.8	Highlighting previously visited links				
9.4.9	Marking links to special targets				
9.4.10	Marking links opening new windows				
9.4.11	Distinguishing navigation links from controls				
9.4.12	Distinguishable within-page links				
9.4.13	Link length				
9.4.14	Redundant links				
9.4.15	Avoiding link overload				
9.4.16	Page titles as bookmarks				
9.5.1	Choosing appropriate interaction objects				
9.5.2	Making interaction objects identifiable and understandable				
9.5.3	Providing keyboard shortcuts				
9.6.1	Readability of text				
9.6.2	Supporting text skimming				
9.6.3	Writing style				
9.6.4	Text quality				

9.6.5	Identifying the language used				
9.6.6	Making text resizable by the user				
10	**GENERAL DESIGN ASPECTS**				
10.1.2	Showing relevant location information				
10.1.3	Identifying supported languages				
10.1.4	Using appropriate formats, units of measurement or currency				
10.1.5	Designing presentation of text in different languages				
10.2	Providing help				
10.3.1	Minimizing user errors				
10.3.2	Providing clear error messages				
10.4	URL names				
10.5	Acceptable download times				
10.6	Using generally accepted technologies and standards				
10.7	Supporting common technologies				
10.8	Making Web user interfaces robust				
10.9	Designing for input device independence				
10.10	Making the user interface of embedded objects usable and accessible				

Appendix 2

Biographical Information of the selected Expert Evaluators

Evaluator 1 (IT Professional)	
Name	Mr. HizbullahKhattak
Designation	Lecturer, Dept. of Information Technology, Hazara University, Mansehra
Qualification	MS in Information Technology (pursuing PhD from Hazara University)
Experience	7 years
Expertise	Web Development
Email	hizbullahkhattak@hu.edu.pk

Evaluator 2 (LIS Professional)	
Name	Mr. Amjad Khan
Designation	Librarian, Dept. of Pharmacy, University of Peshawar, Khyber PukhtunKhwa
Qualification	M. Phil. in Library & Information Science (pursuing PhD from University of Bahawalpur)
Experience	6 years
Expertise	Research publication on Library Website Studies
Email	amjid_irc@yahoo.com

Evaluator 3 (LIS Professional)	
Name	Ms. HaseebaShafi
Designation	Librarian, Central Library, Benazir Shaheed Women University, Peshawar
Qualification	MLISc
Experience	7 years
Expertise	Library Automation and Online Public Access Catalogue
Email	kitab999@gmail.com

Evaluator 4 (IT Professional)	
Name	Mr. Jehanzeb Khan Orakzai
Designation	Additional Directing Staff (IT), National Institute of Management, Peshawar
Qualification	MS in Information Technology (pursuing PhD from IMSciences, Peshawar)
Experience	9 years
Expertise	Web Development, Website Statistics (Monitoring & Evaluation)
Email	janzeb@gmail.com , alternate email: ads.it@nim.gov.pk

Evaluator 5 (LIS Professional)	
Name	Ms. RiffatNaz
Designation	Librarian, Institute of Management Sciences (IMSciences), Peshawar
Qualification	MLISc (pursuing MS from Sarhad University, Peshawar)
Experience	8 years
Expertise	Library Website Management
Email	riffat.naz@imsciences.edu.pk

Appendix 3

Heuristic Form filled by Expert Evaluators

WORKING SHEET FOR EVALUATION OF LIBRARY WEBSITES

Name of the Expert Evaluator _____
Name of University (under evaluation) _____
Website URL _____
Signature of the Expert Evaluator _____

Instructions: Check each heuristic and tick the appropriate number (0="not applicable", 1=not available, 2=available)

	ISO Guideline	**To Check:**	**Web Developer's description**	Explanation / Helping notes	**0**	**1**	**2**
ISO Code	**CONTENT DESIGN**						
7.1.2	Designing the conceptual model						
7.1.3	Appropriateness of content for the target group and tasks interface look and feel	ensure that website looks and feels like a library website	Check the content according to needs. Criteria needs to be developed for related information.	ensure that the website looks like a library website			
7.1.4	Completeness of content	ensure that website contain necessary information needed for a user visiting the library website i.e. collection, membership, OPAC, etc.	As above				
7.1.5	Structuring content appropriately	check that information is organized hierarchically from general to specific	Content structured properly according to the links or multiple information in single link				
7.1.6	Level of granularity	check that each webpage has hyperlinks of information contained therein	Division of Content in smaller parts	having TOC in hyperlinked style which can be clicked to see the further detailed information			
7.2.2	Independence of content, structure and presentation	check if page is accessible on mobile device or not	CSS and XHTML standards used				

7.2.3.1	Selecting appropriate media objects	check if videos or images are given for illustrations or explanation if required so	Media tags properly defined				
7.2.3.2	Providing text equivalents for non-text media objects	check that images/videos contains equivalent textual description and with text-based functionality	Alternate tags defined with images etc.	all images/videos should have text so as to be easily understandable for users			
7.2.3.3	Enabling users to control time-dependent media objects	check if a video or moving image file can be paused or stopped or not	Flash player availability for media				
7.2.4	Keeping the content up to date	check if contents are up-to-date and check last update is given on homepage or not	last editing done in the web site. Earlier the updating done, up to date the content.				
7.2.5	Making the date and time of the last update available	ensure website shows the last updated date and time available	Check the date and time of updates availability				
7.2.6	Enabling communication with the website owner	ensure that website provides contact name, phone, email, postal address of company/individual (website owner)	Email address or feedback form availability and if mail sent, do we get a reply.				
7.2.7	Accepting online user feedback	check that feedback/comments mechanism is available on website or not	Availability of feedback form				
7.2.8.1	Providing a privacy policy statement	If website ask for user's personal information it should provide easy-to-understand policy so make ensure that it specify: nature of information gathered; how the information will be used; with whom info be shared	Availability of privacy statement for viewing and downloading				
7.2.8.2	Providing a business policy statement	Circulation, Membership, and other Relevant Rules/Regulations are given or not	Availability of Business Policy Statement				

7.2.8.3	User control of personal information	can user view, change, give or revoke their consent for personal information being entered i.e. withdraw membership anytime, login availability for users, editing of personal information like Facebook etc. allowed or not	Login availability and editing for profile like Facebook.				
7.2.8.4	Storing information on the user's machine	ensure that website provide information where the user's personal information being stored? Local or international machine?	Cookies enabled.				
7.2.9.2	Taking account of the users' tasks and information needs	check if the website use predefined user profiles for access to information	Availability of editing the interface according to needs of information.	in corporate intranet, users from the financial dept. find links to currency exchange rate information directly on the homepage, while developers are provided with links to technical news on that page			
7.2.9.3	Making individualization and adaptation evident	providing users with means for customizing the user interface to their personal needs i.e. individualization designing content and navigation differently for varying user groups or roles i.e. such as employees of different levels, citizens etc.	It should be made evident to the user when individualizatio n and/or adaptation are used.	providing users with means for customizing the user interface to their personal needs i.e. individualization designing content and navigation differently for varying user groups or roles i.e. such as employees of different levels, citizens etc.,			
7.2.9.4	Making user profiles evident	If predefined user profiles or user-specified profiles are used for individualizing or adapting content, the profile currently used should be made evident.					

7.2.9.5	Allowing users to see and change profiles	check if user can see, modify and delete profiles on demand	Availability of editing profile and personal information				
7.2.9.6	Informing about automatically generated profiles	see if user is informed about his previous interest/search/navigation of items on the website		based on user navigation actions, a news website generates user profile to recommend topics that are likely to be of interest to this user.			
7.2.9.7	Switching off automatic user adaptation	check if the website use automatic user profile creation		the turn off availability of automatic user profile generation should be available			
7.2.9.8	Providing access to complete content	check if website provides access to complete contents or requires authentication to do so	Content Management System availability	if authentication is required i.e. member login then all contents should be available to logged in user			
	NAVIGATION						
8.2.1	Making navigation self-descriptive	website shows the path of current webpage at the right-top under main banner	Breadcrumbs and links properly defined according to content	NOW VIEWING: HOME > JORDA > JORDA PAPERS > INBOX | NOW VIEWING: NEW PAPERS ▼			
8.2.2	Showing users where they are	showing place in the overall navigation structure	Breadcrumbs availability on each page.				
8.2.3	Supporting different navigation behaviours	check that navigational links are simple and understandable for common user	Multiple menu's availability				
8.2.4	Offering alternative access paths	important link can be accessed using different navigation paths	Most viewed pages displayed on each page etc.	for example OPAC should be accessible from different locations on a library website			
8.2.5	Minimizing navigation effort	check that navigational tabs are accessible from all pages	Menu's availability				
8.3.2	Choosing suitable navigation structures	check that website navigation is hierarchical in nature	Drop down menus vs. static menus vs. links				

8.3.3	Breadth versus depth of the navigation structure	navigational links are meaningfully labeled and logically grouped for one page	Links presented in breadth and depth of each link with further pages				
8.3.4	Organizing the navigation in a meaningful manner	check that navigational links are content-based, task-based, frequency-based or any other form of organized manner	Is the link and sub links of that link relevant to each other	library website requires task-based navigation where relevant documents are linked with the single steps of searching procedure. Additional content-based access may be given			
8.3.5	Offering task-based navigation	see if website offers "quick links" or not	Present a menu that is based on the task user is performing.				
8.3.6	Offering clear navigation within multi-step tasks	website provides clear indication of users' current position and allowing to move to previous steps and correct their entries in case of filling a form or inputting information	When a main page is displayed, does the navigation display its subpages?	for example on OPAC if made a wrong entry does it provide to go back and correct or not? Similarly if inputting member information does it provide to rollback and correct entry?			
8.3.7	Combining different ways to organize navigation	see breadcrumbs are there at the website or not?	Menu's availability + Right or left menu + Bread Crumbs + Most Viewed	Breadcrumbs typic ally appear horizontally across the top of a web page, often below title bars or headers. They provide links back to each previous page the user navigated through to get to the current page or—in hierarchical site structures—the parent pages of the current one			
8.3.8	Informative home page	see the information is available regarding purpose, organization, main contents, news/updates,	Home page contains news / updates etc. and basic info regarding the organization	zero marks for website having "empty" homepage showing only few links and also zero marks for websites overloaded contents			

8.3.9	Directly accessing relevant information from the home page	Navigation-only pages (such as the home page) can be viewed without scrolling	Are all the links present at the home page?				
8.3.10.1	Avoiding unnecessary splash screens	three splash screen are allowed otherwise nor recommended	No advertisements or animations without purpose				
8.3.10.2	Skipping splash screens	if splash screen is used "Skip Button" be given to turn it off	Close / Skip button availability for advertisements	especially for flash-based splash screen			
8.3.11	Avoiding opening unnecessary windows	additional windows, new browser windows or pop-ups should only be opened if this supports user task	Gmail does not allow you to open windows by right clicking				
8.4.2	Providing navigation overviews	see that visible, expandable navigation menu is shown on the left side of website or not?	Is there a help for navigating the website?				
8.4.3	Maintaining visibility of navigation links	Colour contrast used for the links is clear.	Colour contrast used for the links is clear.	for long pages navigational links are given both at the top and at the bottom or not?			
8.4.4	Consistency between navigation components and content	see that selected navigational link is highlighted in the navigation pane or not	All pages using the same format for links text, images and navigation				
8.4.5	Placing navigation components consistently	All navigation links are displayed the same way on each page	All navigation links are displayed the same way on each page				
8.4.6	Making several levels of navigation visible	Hierarchical expansion of navigation pane is available or not?	Drop down menus availability with depth more than 2				
8.4.7	Splitting up navigation overviews		Are navigation overview / help available for different materials				
8.4.8	Providing a site map	see site map button is available or not?	Site map availability with a link				
8.4.9	Providing cross linking to potentially relevant content	see if contents of pages provide useful links or not?	People who have viewed this page have also viewed …				

8.4.10	Making dynamic navigation links obvious		Dynamic Navigation links presented in another colour more appealing	advisable is to keep static navigation links in place and easily reachable. Secondly dynamic navigation links are placed in other color is more appropriate			
8.4.11	Linking back to the home page or landmark pages	Home page button availability at each page	Home page button availability at each page				
8.4.12	Going back to higher levels	Breadcrumbs availability	Breadcrumbs availability	Breadcrumbs typic ally appear horizontally across the top of a web page, often below title bars or headers. They provide links back to each previous page the user navigated through to get to the current page or—in hierarchical site structures—the parent pages of the current one			
8.4.13	Providing a “step back” function	Clicking the back button always takes the user back to the page the user came from	Back button availability				
8.4.14	Subdividing long pages	if pages are long they should be subdivided into sections	Headings on each page with anchors				
8.4.15	Explicit activation	"submit button" is normally used to confirm the selected option before going to a new page		users could confuse the selection of an option with the activation of a navigation step			
8.4.16	Avoiding dead links	navigational links that target the contents/pages within same website should not be dead ends	Are there any dead links on the website that lead to page not found?				
8.4.17	Avoiding incorrect links	are there nonfunctional links?	Are there any incorrect links that lead to page not found?				

	SEARCH						
8.5.2.1	Providing a search function		Search availability to search content on the site				
8.5.2.2	Providing appropriate search functions						
8.5.2.3	Providing a simple search function		Availability of basic search				
8.5.2.4	Advanced search	ensure advances search button and function also	Availability of advance search				
8.5.2.5	Full-text search	ensure that website provide full-text search option	Availability to search all the fields				
8.5.2.6	Describing the search technique used		Help regarding the search				
8.5.2.7	Availability of search	search function be available from all pages of the website	Search availability to search content on the site				
8.5.2.8	Search field size		How many characters could be input in the search field				
8.5.2.9	Shortcut to search function	pressing "Enter" button executes the search	Shortcut link available to search the content.				
8.5.2.10	Error-tolerant search	when misspelled word is entered in query, the system presents both the results of searching for the incorrect term as well as suggest to search again with corrected term	If a wrong keyword is entered in search, does it check for errors?				
8.5.3.1	Ordering of search results	sorting of results be mentioned e.g. new/old, relevancy, ascending/descending etc.	Can the search results be manipulated in ascending or descending order				
8.5.3.2	Relevance-based ranking of search results	Search results are clear, useful and ranked by relevance	Is the most relevant result after search displayed at the top?				
8.5.3.3	Descriptiveness of results	see if ranking of results is clear to user or not i.e. any information given for ranking of result or	Are descriptions made available with the search results?				

		not					
8.5.3.4	Sorting or filtering search results	Can we sort or further filter the search results?	Can we sort or further filter the search results?				
8.5.4.1	Scope of a search	see OPAC search and Website Search is given separately or otherwise?		searching OPAC and searching contents of the website is different in scope			
8.5.4.2	Selecting the scope of a search	If one search is available, is it optioned with Web or OPAC search?	Is the search divided into a scope field along with keywords?				
8.5.4.3	Providing feedback on the volume of the search result	Is the total number of records displayed at the top or bottom for a keyword	Is the total number of records displayed at the top or bottom for a keyword				
8.5.4.4	Handling large result sets	is pagination available for large results?	Is pagination made available				
8.5.4.5	Showing the query with the results	Search query is displayed with results or not?	Is the keyword / query displayed at the top / bottom of the page				
8.5.5.1	Giving advice for unsuccessful searches	ensure spell check availability	Is there a mechanism for spell check				
8.5.5.2	Repeating searches	page showing results should contain options to search again with changed query on the same page					
8.5.5.3	Refining searches	in large search results a mechanism for refining search within result set is available or not?	Can we refine our search when the results are displayed				
	CONTENT						

	PRESENTATION						
9.3.1	General page information	ensure that every page has descriptive title					
9.3.2	Consistent page layout	same information should be available at same place on each page	Is every page on the site has the same look and feel				
9.3.3	Placing title information consistently	page title should be placed at same location on linked/different pages	Is the title of the page displayed and is consistent with the layout				
9.3.4	Recognising new content	newly placed content is highlighted or made blinking to draw user's attention	Is the site providing date / time for the content				
9.3.5	Visualising temporal status	NOT APPLICABLE		if content of page is valid for certain period of time, it should be displayed/indicated by appropriate means			
9.3.6	Selecting appropriate page lengths	homepage, overview page, navigation pages are short long pages are good for full-text reading material	Are all pages of same length or are different				
9.3.7	Minimise vertical scrolling	website does not require long scrolling to read text	Is there vertical scroll bar displayed in any browser for the site?				
9.3.8	Avoiding horizontal scrolling	no horizontal scrolling is given for text reading or navigational buttons	Is there horizontal scroll bar displayed in any browser for the site?				
9.3.9	Using colour	using too many colors are avoided to order to give clear text visibility and is in contrast with other colors	Limited colour combinations and not a mess of colours				
9.3.10	Using frames with care	bookmarking, scrolling, and back button is available within the frame	Frames are used or not and properly placed in content where needed				
9.3.11	Providing alternatives to frame-based presentation	alternative to frame-based presentation is necessary see EXPLANATION	Accordions(collapsible content panels for presenting information in a limited amount	cell-phone based browsers are not comfortable with frame-based presentation, if website is			

			of space) used instead of frames	available on cell phone then this criteria is met			
9.3.12	Providing alternative text-only pages	see if text-only version of website is available or not?	Are text only pages made available for mobile devices with images off				
9.3.13	Consistency across related Web sites	NOT APPLICABLE	Is the information consistent with respect to other websites on the subject	if organization maintains several websites addressing the same audience the overall design should be consistent for each of them			
9.3.14	Using appropriate techniques for defining the layout of a page	use of CSS instead of HTML (see EXPLANATION)		consult IT expert to validate either website tables are in CSS or HTML			
9.3.15	Identifying all pages of a Web site	see if logo of organization exists on all pages of the website or not?					
9.3.16	Providing printable document versions	printing option is available for pages of the website or not	Print CSS defined separately				
9.3.17	Use of “white space”	contents are placed/presented with appropriate line and paragraph spacing	Availability of white spaces				
9.4.2	Identification of links	external links are prominent using underlining, highlighting, color-coding etc.	Links presented in different colour or underlined				
9.4.3	Distinguishing adjacent links from each other	if several links are shown in one section/para it should be separated from one another i.e. color, spaces etc.		if several links are shown in one section/para it should be separated from one another i.e. color, spaces etc.			
9.4.4	Distinguishing navigation links from transactions	Text links are used for navigation from one page to another and buttons are used for transections that manipulate data i.e. calculation, searching, confirming					

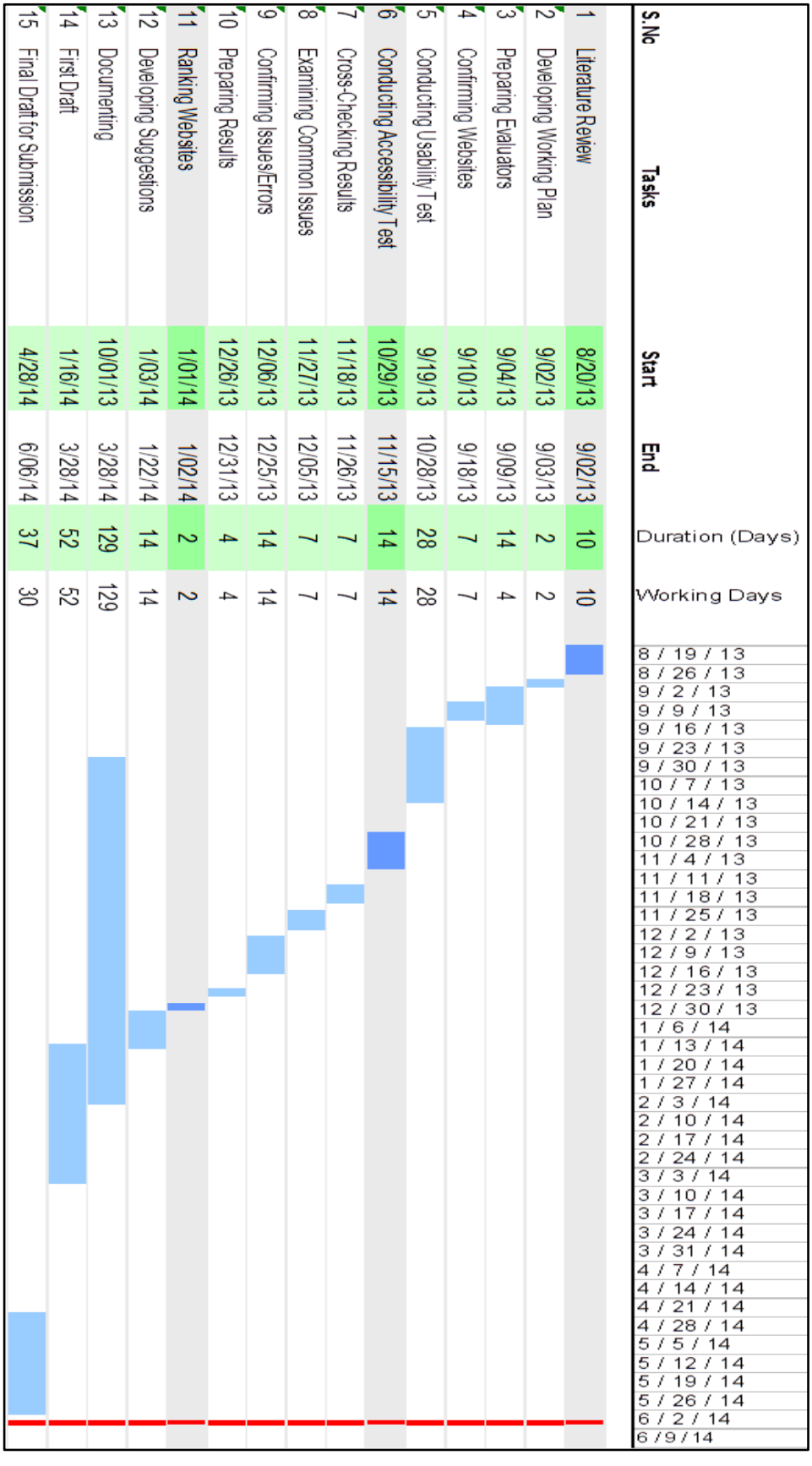
9.4.5	Self-explanatory link cues	links, buttons, images, icons, tool-tips are self-explanatory		links are clearly understandable to general users			
9.4.6	Using familiar terminology for navigation links	links are familiar to users i.e. home, contact us, search, login, membership, OPAC etc.					
9.4.7	Using descriptive link labels	use phrase and descriptive links rather than just using "go" or "click here"	links displayed with text at their bottom as descriptions				
9.4.8	Highlighting previously visited links	OK	Linkcolour changes if it's visited.				
9.4.9	Marking links to special targets	link leading to PDF document is labeled with filename preceded by text showing letters "PDF" that indicates that file is in PDF format	Some links open in same window when required and some open another				
9.4.10	Marking links opening new windows	links that opens new browser windows or pop-up windows are marked separately	does the link open in the same window or opens another window for the user				
9.4.11	Distinguishing navigation links from controls	Text links are used for navigation from one page to another and buttons are used for transections that manipulate data i.e. calculation, searching, confirming					
9.4.12	Distinguishable within-page links	within-page links should be clearly distinguishable from links pointing to different pages	Mark pages in the text if they are links.				
9.4.13	Link length	links are long enough to be understandable but short enough to avoid text wrapping	Maximum length of the link in the browser				
9.4.14	Redundant links	if more than one link pointing to same target is provided on a page label of the redundant link be consistent					
9.4.15	Avoiding link overload	link text should not impede the readability of text					

9.4.16	Page titles as bookmarks	page titles are usable as bookmark titles					
9.5.1	Choosing appropriate interaction objects	radio buttons are available for selecting single option from a multi-choice criteria/menu					
9.5.2	Making interaction objects identifiable and understandable	row of tabs at the top of page is shown as buttons with clear labels					
9.5.3	Providing keyboard shortcuts	website allow important keyboard shortcuts or not i.e. ctrl+p for printing, crtl+s for saving etc.	Keyboard shortcuts availability in the website				
9.6.1	Readability of text	text of website is readable enough having appropriate size and visible appearance	Text font and size for text				
9.6.2	Supporting text skimming	skimming of text be supported by highlighted keywords, logical headings, and short phrases etc.	Headings, sub headings and sub sub headings properly defined				
9.6.3	Writing style	website text be suitable, short sentences be used, division of text into shorter chunks or bullet points					
9.6.4	Text quality	run spell check on website to check this criteria, please	New material				
9.6.5	Identifying the language used	language conversion option be checked	No of languages the website is available in				
9.6.6	Making text resizable by the user	text resizability is available for user or not	Resizable text enabled for the website through the browser				
	GENERAL DESIGN ASPECTS						
10.1.2	Showing relevant location information	Google or yahoo maps enabled for the location of office or organization to which the website belongs	Google or yahoo maps enabled for the location of the office or organization to which the				

			website belongs				
10.1.3	Identifying supported languages	does website allow display of other languages or is the text available in regional or local language?	No of languages the site could be displayed inn				
10.1.4	Using appropriate formats, units of measurement or currency	if required so the currency/unit exchange facility is available at the website	The currency could be changed for a specific region of the world?				
10.1.5	Designing presentation of text in different languages	does the website properly display text i.e. left to right or right to left whatever is required	Is the site designed for different languagese.g., Left to Right and Right to Left				
10.2	Providing help	check if website allows user to get help or is help tab available at the website	Help availability on the site				
10.3.1	Minimizing user errors	check if inputting text is error-tolerant or not	Checks for form filling or if email not entered where forms are available				
10.3.2	Providing clear error messages	does website display clear and understandable error messages or display error codes only	Does the site gives an understandable error message or confuse the user				
10.4	URL names	URL of website should be easy to remember normally it should be based on the organization/agency's name	URL names used / translated for better SEO				
10.5	Acceptable download times	check if website downloads quickly or takes time or are there unnecessary flashing	Is the site quick to download and display the material or too heavy to take more time				
10.6	Using generally accepted technologies and standards		WML for mobile sites and XML for others has been followed				

10.7	Supporting common technologies	check if website is accessible with older browsers or with browsers with advanced features turned off	XHTML and CSS used as a standards				
10.8	Making Web user interfaces robust	Content must be robust enough that it can be interpreted reliably by a wide variety of user agents	Web user interface used has icons				
10.9	Designing for input device independence	means that the user may interact with the user agent or document with a preferred input (or output) device -- mouse, keyboard, voice, head wand, or other.	Can the website be used with keyboard and touch devices?	If, for example, a form control can only be activated with a mouse or other pointing device, someone who is using the page without sight, with voice input, or with a keyboard or who is using some other non-pointing input device will not be able to use the form			
10.10	Making the user interface of embedded objects usable and accessible			When an embedded object has its "own interface", the interface -- like the interface to the browser itself -- must be accessible. If the interface of the embedded object cannot be made accessible, an alternative accessible solution must be provided			

SCHEDULE OF STUDY (GANTT CHART)



S.No	Tasks	Start	End	Duration (Days)	Working Days
1	Literature Review	8/20/13	9/02/13	10	10
2	Developing Working Plan	9/02/13	9/03/13	2	2
3	Preparing Evaluators	9/04/13	9/09/13	14	4
4	Confirming Websites	9/10/13	9/18/13	7	7
5	Conducting Usability Test	9/19/13	10/28/13	28	28
6	Conducting Accessibility Test	10/29/13	11/15/13	14	14
7	Cross-Checking Results	11/18/13	11/26/13	7	7
8	Examining Common Issues	11/27/13	12/05/13	7	7
9	Confirming Issues/Errors	12/06/13	12/25/13	14	14
10	Preparing Results	12/26/13	12/31/13	4	4
11	Ranking Websites	1/01/14	1/02/14	2	2
12	Developing Suggestions	1/03/14	1/22/14	14	14
13	Documenting	10/01/13	3/28/14	129	129
14	First Draft	1/16/14	3/28/14	52	52
15	Final Draft for Submission	4/28/14	6/06/14	37	30

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