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Shailendra Kumar Gareema Sanaman

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Web challenges faced by blind and vision impaired users in libraries of Delhi
An Indian scenario

Shailendra Kumar and Gareema Sanaman
*Department of Library and Information Science,
University of Delhi, Delhi, India*

Abstract

Purpose – The purpose of this paper is to analyse the challenges faced by blind/vision-impaired users during the web access in the leading academic and special libraries of Delhi, India.

Design/methodology/approach – Survey methodology has been used as the basic research tool for data collection with the help of questionnaire. A total of 125 users surveyed in all the five libraries are selected randomly on the basis of willingness of the users to participate in the survey with the experience of working in digital environment. The survey results were tabulated and analysed with descriptive statistics methods using Excel software and "Stata version 11".

Findings – There are various barriers faced by blind/vision-impaired users in the libraries of Delhi (India) during the "web access" with the help of assistive technologies as assistive technology like "Screen Readers" available today are "somewhat compatible" with the web. The facility of "web-based catalogue" is generally lacking in Delhi libraries.

Research limitations/implications – The paper does not offer a comprehensive set of web accessibility issues, concentrating instead on the most common problems as epitome of this study.

Practical implications – The paper raises awareness of web accessibility issues in libraries of Delhi, India.

Originality/value – The paper highlights the web accessibility issues faced by blind/vision-impaired users of leading academic and special libraries of India including the users' recommendations for the accessible web page/website design for the first time.

Keywords World wide web, Web accessibility, Web access, Web-based catalogue

Paper type Research paper

1. Introduction

The World Wide Web has been around for more than a decade, providing access to thousands of web applications. Despite web accessibility standards available today, along with the disability discrimination legislation in many Western countries, much of the web remains inaccessible to the disabled population (Adam and Kreps, 2006). The reason behind this inaccessibility is the severe lack of awareness about accessible web design issues among web developers, companies and institutions that purchase web-based products (Byerley and Chambers, 2002). The accessibility of web-based information for the disabled can be improved by the use of access technology and adopting good practices in interface design. For example, assistive equipment enables a visually impaired user to access on-screen information and, if this information can be interpreted by any kind of access technology, then it is referred to as "accessible web

design", "design for all" or "universal design". In a library environment, "design for all" means that a library's information technology systems and interfaces are designed in such a way that users can easily access and interact with it regardless of their location, type of disability or any preference of access (Brophy and Craven, 2007). Universal web design greatly reduces the cost of assistive technologies geared specifically to individual computer workstations; therefore, it can prove beneficial for the disabled community as a whole rather than achieving accessibility through a segregated, compartmentalized and/or *ad hoc* approach. Accessible web design enables people with low-end browsers, slow modems and/or narrow bandwidth to access the web and to participate fully in the online environment (Yu, 2002). Web accessibility generally emphasizes on making websites accessible to persons with disabilities and removing potential barriers to access caused by inconsiderate website design. There are many services that are available or offered at a discounted rate over the Internet today and, if a website does not have an accessible design, then it is impossible for many potential users with any kind of disability to use these services (Curran *et al.*, 2007). Assistive devices, such as modified computer keyboards, audio web browsers and screen readers with speech or Braille output which provides access to electronic text, depend on the design of the web environment to provide a good response. Even the most advanced assistive devices cannot overcome the barriers associated with inaccessible design. When librarians fail to select accessible resources, true disability, with all its negative ramifications, is created (Stewart and Narendra, 2005).

In India, the National Knowledge Commission (NKC) has asked librarians "to identify the constraints, problems, and challenges" to recommend changes, so that necessary steps can be taken "to mobilize and upgrade the existing library and information systems and services" (http://knowledgecommission.gov.in/downloads/documents/NKC_Library.pdf). Hence, librarians can step into leadership roles by showing their expertise and initiating new innovative means to develop and provide specialized services to these special groups who do not have access to normal services, as it is the democratic, constitutional right of differently abled users (Roy and Bandyopadhyay, 2009). Web-based information has many benefits to people with disabilities in comparison with printed resources and services. This is due to the fact that users can interact effectively with the electronic environment with the help of the assistive technologies available today. As Cantor (1996, p. 45) stated "the accessibility of your library will not be judged by the sophistication of the technologies you have, but by the comprehensiveness of the services you offer". In this regard, the following study explores the issues and problems faced by the blind and vision-impaired users in the libraries of Delhi in India, while trying to access web resources, and is accompanied with their recommendations to design an accessible user interface to access the web. Thus, the present study consists of the following objectives:

- to identify the usability of web-based catalogues in the library for blind and vision-impaired users;
- to find the degree of compatibility of screen readers used by blind and vision-impaired users with web-based resources;
- to explore the frequency of difficulties faced during web access with assistive technology by blind and vision-impaired users;

- to study the level of difficulty faced by blind and vision-impaired users during access or use of web-based tables;
- to learn users' opinions regarding the accessibility of their library web page/website design; and
- to examine users' viewpoints regarding accessible web page/website design.

2. Review of related studies

The purpose of this research is to determine the challenges faced by blind and vision-impaired users in the libraries of Delhi in India when using the web, as well as to raise awareness of web issues related to the use of assistive technology in libraries. The main objective for conducting this research is to explore the various problems and barriers faced by the blind and vision-impaired community during web access and to examine their viewpoints regarding the accessibility of web pages/websites. Access to web applications is becoming an important issue for people with disabilities; therefore, the following literature review focuses on the role of assistive technologies for web access and discusses the importance of web-based catalogues as an information resource for users. The various problems faced by blind and vision-impaired users due to inaccessible web design are also addressed, along with recommended solutions to provide online access.

2.1 Role of assistive technology in information access

Assistive technologies play an important role in equalizing opportunities for people with disabilities in many aspects of life, as this technology enables them to overcome the limitations and obstacles faced in printed or digital environments (Koulikourdi, 2008). Accessible technologies accompanied by the Internet can have a remarkable effect on empowering people with disabilities, as it provides a great opportunity for the connectivity of a broader range of people regardless of their location (Baker *et al.*, 2009). In earlier times, access to information was a major problem for the disabled, but today, information and communication technology, along with assistive technologies, have helped to reduce the digital divide between the sighted and the blind by providing information on their desktop (Koganuramath and Choukimath, 2009).

Technology has opened up new areas of participation and activity for people with disabilities that were inaccessible just a few years ago, and it is vital to ensure that users are able to use these enabling technologies in libraries (Dixon, 1996). Information can be provided to people with disabilities if libraries make the necessary arrangements by providing them with computers equipped with assistive technology for the maximum utilization of electronically published materials (Berliss, 1994). But:

> […] on the road to making libraries more accessible to people with disabilities, librarians often get stuck in technological mud. The choices are overwhelming and many librarians feel they lack the technical expertise to select appropriate equipment (Cantor, 1996, p. 41).

Thus, before implementing new services in the library for the disabled, librarians need to refer to the various bibliographical sources dealing with the problems of providing library services to the disabled, read the literature exploring each library's particular experience with technological equipment in detail which can help in decision-making (Bekiares, 1984) and select suitable technology for their library and users.

Although, to some extent, the ability to access web-based information can be enhanced and achieved through the application of the proper assistive technology, assistive technology alone cannot overcome all the barriers posed by inaccessible web design. Schmetzke (2001), in her study of web accessibility undertaken at the 24 most highly ranked Schools of Library and Information Science at universities in the USA, found low web page accessibility. The author suggested that this result reflects a lack of awareness about the issue among the leaders and trainers in the library profession. Thus, there is a need for librarians to focus on how persons with disabilities access web-based content and evaluate the challenge of web design. Resources are available to assist library professionals to obtain and evaluate product accessibility information from vendors. Librarians should explore the current standards and recommendations regarding the accessibility of web resources, subscribed databases and library websites (Vandenbark, 2010). The documents which are considered authoritative and provide comprehensive guidelines for the design of accessible websites include the Web Content Accessibility Guidelines issued by the World Wide Web's Web Accessibility Initiative (W3C/WAI) and the federal access board standards issued under Section 508 of the Rehabilitation Act of 1964 which was amended later in 1998 (Stewart and Narendra, 2005).

2.2 Problems and recommended solutions to web access

The World Wide Web has become a vital part of the social infrastructure, but from an information-seeking perspective, it is still a complex environment. Information seekers in the World Wide Web need to switch and coordinate with different information seeking strategies such as browsing, scanning, query-based searching and so forth. Multimedia and the hypertext nature of the World Wide Web has changed the way people seek information, but can cause disorientation and cognitive overload problems. People with disabilities, particularly vision-impaired users, can obtain invaluable benefit through web-based services, such as online shopping, web banking, news and public services, but it is difficult for them to use these services effectively and efficiently (Kouroupetroglou *et al.*, 2008). There are various situations in which disabled people face problems during web access. For example, blind and visually impaired people generally use speech synthesis software to read the text on web pages, or screen readers and voice browsers to surf the web. For these to work properly, there must be correct and accessible coding of web pages to allow the assistive technologies to successfully translate the site's contents for their users (Adam and Kreps, 2006).

The increasing provision of web-based information resources has moved from a simple text interface to dynamic and interactive designs. This has led to more creative and flexible experiences for most users, but people with disabilities may be excluded, as they cannot use standard methods of access. In particular, those who use assistive technologies, such as screen readers, are most at risk of being excluded from access. Despite a growing awareness of web accessibility issues, people are still experiencing barriers to access. Problems using Flash, JavaScript and PDFs are usually most often cited by users, followed by navigational problems that occur due to a lack of understanding of the different ways users interact with and navigate web-based resources (Brophy and Craven, 2007). When the navigation strategies of blind and partially sighted users were identified, including the perceptions of page layout and graphics when accessing the web with current assistive technologies, it was found that

these technologies impose navigational constraints and provide limited information on web page layout. Extraneous information, such as repetitive links and images, present in major purchasing and entertainment sites, was found to be difficult to negotiate using a screen reader (Murphy *et al.*, 2008). Although it is quite easy for most users, there are many problems for people with disabilities when navigating the web. To solve this problem, the Browsing Shortcuts mechanism can be introduced to enable blind people to move efficiently to various functional elements of a web page, such as forms, navigational aids and so forth (Kouroupetroglou *et al.*, 2008).

Access to electronic resources and services has been enhanced through web-based interfaces in libraries. Library websites have evolved into information gateways providing access to various library services and resources, including electronic databases, library catalogues, research tools and the Internet (Yu, 2002). However, the shift towards graphical user interfaces and complex web design has placed barriers to information access for disabled people (Horwath, 2002). People with disabilities, especially the vision-impaired, face many access problems with the Internet, as web designers often ignore the needs of disabled people when testing the accessibility of their designs. Inaccessible design results in reduced access to the Internet for the disabled. Therefore, it is necessary to develop a special human-computer interface (HCI) system for vision-impaired people, so that they can browse the web. A knowledge-based HCI system can have a substantial impact on reducing the digital divide with broader access to Internet services for disabled users (Loo *et al.*, 2003). Today, search engines are the most significant tool for surfing the Internet; therefore, Oppenheim and Selby (1999) looked at how three search engines – AltaVista, Yahoo! and Infoseek – presented information to the visually impaired and blind users and how accessible individual Internet pages were. On the basis of the users' feedback on interface design, web designers were found responsible for the barriers faced by users in information access due to insufficient thought given by them during the design phase. Today, web designers are using different access technologies, such as Java applets, JavaScript and plug-ins, which are inaccessible to screen readers. These should be avoided, but, if absolutely required for the design of the site, then alternative access should be provided. Hence, there are many solutions available for website designers to consider when designing pages to improve web accessibility for the vision-impaired, even when using sound and tactile displays (Walsh, 2006). Major features that are of importance in web page design include the use of HTML code standards, as extensions to the HTML standard cannot be validated and make Braille translation very difficult. Page design and navigation should be simple, consistent and clear throughout the site. A text index or site map should be available to direct users to relevant pages. There should be less use of graphics and images, and these should be accompanied by alternative text to describe the image which will let Braille or speech synthesis software relate the content of that image to the user. The use of italic text should be avoided, as this can appear "wobbly" on screen. Also, the use of frames on a site should be avoided, as some access devices cannot read the information held in frames, but if frames are used, a text alternative should be provided (Oppenheim and Selby, 1999).

Some features designed to be appealing to the sighted user make Internet pages inaccessible to a visually impaired user, including screen design, font size, colour, patterns in screen backgrounds that make the text difficult to read and an excess of graphics (Oppenheim and Selby, 1999). If information is to be conveyed through colour,

sound or image, an alternative description should be placed in the HTML coding. The alternative description can then be read by a screen reader. Row and column headings should be used to give direction to users if tables are used on the website (Loo *et al.*, 2003). Designers and developers of online learning materials can incorporate assistive technologies and universal design to make online materials more accessible to disabled learners. The use of images, such as pictures, graphics, banners, flash animations, movies, navigational buttons and some types of PDFs, tables and charts, should be avoided during the development of learning materials for the blind, as screen readers can only read text. The use of layout tables should be minimized, as it helps screen-reading devices read the entire text without any interruption (Crow, 2008).

Inaccessible web design causes unnecessary problems to certain website users. Curran *et al.* (2007) assessed the compliance of a selection of websites with guidelines set out by WAI. It was found that most sites evaluated were inaccessible to those with disabilities, and only one of the selected sites passed all three priority levels set out by WAI. In a study by Lewis and Klauber (2002), the impact of inaccessible web design was viewed from the perspective of a librarian who is legally blind. The study presented real-life examples of the obstacles that inaccessible web design had presented to the librarian and to the patrons who are blind or visually impaired and offered suggestions to make library websites accessible (Lewis and Klauber, 2002). Problems of inaccessibility are further compounded by a reliance on automatic checkers, which cannot fully verify the accessibility of a website (Adam and Kreps, 2006). For example, Bobby (now renamed WebExact) is a well-known software developed by a non-profit organization called the Center for Applied Special Technology which can check most, but not all, web page accessibility problems (Loo *et al.*, 2003).

2.3 Web-based catalogue as an information resource
Another issue related to disabled users is the lack of options for locating and selecting reading and information materials. Today, many libraries are going into a new phase of digital production and trying to use the full potential of options to meet user needs. Catalogues are one of the most important tools for resource discovery in the library for people with disabilities, especially visually impaired users. The traditional library catalogue is unable to meet the accessibility needs to information resources for users; therefore, a web catalogue has a major role to play, and it has the advantage of storing accessible materials in a digital format that can facilitate large-scale updates (Westlind, 2008). The production and distribution of information resources in alternative formats to meet the needs of people with disabilities is haphazard and uncoordinated, if the information is not organized and properly catalogued; therefore, there is a need to set up a computerized web-based catalogue and a distribution database of alternative materials for them, especially for visually impaired people. A distribution database is not a full-text database, but it gives cataloguing information about each item and the addresses of organizations serving people with disabilities in the country, etc. There is a need to expand the availability of these resources, nationally and internationally, to this category of information users by identifying the location and availability of resources, and creating a database for access and retrieval. The database could become the foundation of a network of organizations and institutions working for the disabled population (Atinmo, 2007).

Designing a catalogue for disabled people requires consideration of several aspects, starting with the tasks of finding, identifying, selecting and obtaining the appropriate information suitable for their use. The improvements for people with disabilities provide several features that add benefits for sighted people as well, as both use similar routes to find and select resources appropriate to their needs (Chapman, 2007). A dynamic cataloguing solution is necessary to meet the growing number of accessible materials which are mainly digital and increasingly dynamic. Here, a "dynamic catalogue" uses at least five kinds of dynamic properties for accessible materials in digital archives that make large-scale updates possible: those that can produce a variety of end-user products, like DAISY (six types), Braille and e-text; those that allow a variety of distribution forms through mail, e-mail, downloads, streaming, etc.; those that support a variety of available formats and carriers, such as .ISO, .ZIP, CD-ROM, DVD, etc.; and finally, those that provide the possibility for end-users to compile parts of relevant materials. The other advantage of a dynamic cataloguing solution is the display of potential end-user products, as it not only displays what already exists but also shows what can potentially be created (Westlind, 2008).

Studies show that on-demand digitization of analogue library materials can be done to increase access to current library holdings. Further studies will emphasize on the development of the web catalogue based on the World Wide Web Consortium (W3C) standards for the disabled community where automatic updates are possible and librarians need not manually re-catalogue large collections.

3. Scope and methodology

The library profession has long championed providing services and materials to all its patrons equally which is one of the fundamental beliefs inherent in this profession (Riley, 2002). It is already established that access to information is one of the most important human rights to allow individuals to develop themselves and actively participate in a democratic society, fully exercising their rights and duties (Todaro, 2005). Thus, all citizens should have equality in access to information, which will enable them to be active contributors and participants in society. In this modern digital age, assistive technologies play an important role in the lives of people with disabilities to provide them access to a variety of resources and services available in libraries, as well as on the web. Therefore, the present study is mainly focused on the study of web challenges faced by blind and vision-impaired users in libraries of Delhi, India, while working in a digital environment.

The scope of the present study is limited to Delhi (the capital of India) only, and the survey population in each library is taken on the basis of the availability of users during the time of the survey. The total number of 25 (i.e. equal to 100 per cent; representative population from each library) users in each of the five libraries was selected as the survey respondents on the basis of their willingness to participate in the survey with the experience of working in a digital environment. The total number of users surveyed is based on random selection and categorized as faculty members, research scholars, graduates, post-graduates, high school and intermediate students enrolled in various academic and vocational training courses in different institutions in Delhi, India. The data were collected through a survey method with the help of a questionnaire along with the personal assistance provided to the users as and when required by them because of the different degree of impairment or disability suffered by the users (i.e. mild, moderate,

severe or complete). Accessibility and availability issues regarding information were discussed with experts, teachers and disabled individuals, and the questions proposed by them were included in the questionnaires prepared for the final research study. Personal interviews on a one-to-one basis with users with disabilities were also done to get the conceptual clarity about the various issues related to their disability and the barriers faced during the access of information in the digital environment. The survey was conducted in the year 2012. A total of 125 questionnaires were distributed among the users in each library, i.e. 25 (equal to 100 per cent; a representative population from each library), of which 80 per cent (20 responses) were received from Amba Dalmia Resource Centre (ADRC) and Hellen Keller Unit (HKU) each, 72 per cent (18) each from Braille Library (BL) and Ram Nath Batra Talking Book Library (RNBTBL) and 60 per cent (15) from Durgabai Deshmukh College Library (DDCL), respectively.

The survey results show that the least number of faculty members (8 per cent) responded from BL, University of Delhi. The total number of graduates (35) constitutes the major category of users who responded to the survey (80 per cent from ADRC, 48 per cent from DDCL and 12 per cent from RNBTBL), followed by the post-graduates (21), constituting 40 per cent, 32 per cent and 12 per cent from HKU, BL and DDCL, respectively. Only 18 research scholars participated in the survey, that is, 10 (40 per cent) from HKU and 8 (32 per cent) from BL, whereas only 15 (60 per cent) high school/intermediate students from RNBTBL responded to the questionnaire.

A total of five academic and special libraries were selected for the study of blind and vision-impaired people, including:

(1) ADRC, Miranda House;
(2) DDCL, Blind Relief Association;
(3) BL, University of Delhi;
(4) HKU, Jawaharlal Nehru University; and
(5) RNBTBL, National Association of the Blind.

The data were analysed by applying descriptive statistics methods using Excel software and Stata version 11, and presented in the form of tables and graphs for a clearer understanding of the survey results.

4. Data analysis and findings

There is a varied degree of vision impairments suffered by blind and vision-impaired users. The survey results indicate that out of the total (91), a majority of respondents (59) have no vision at all or are completely blind (100 per cent vision loss) in all the libraries, and 28 respondents have severe vision impairment (only 10-15 per cent vision). Users with mild or moderate vision impairment were found only at HKU and the RNBTBL library, which constitutes the least population for the survey (i.e. only two respondents in each category in both of the libraries).

Figure 1 clearly shows that a majority of the survey participants in all the libraries have no vision at all or are completely blind.

4.1 Access to the web-based catalogue

The web-based catalogue is an important resource of information for people with disabilities as it provides equal access and equal opportunity to access all the library

resources, despite their disability, from anywhere and at any time. In this regard, Table I explores whether the libraries serving the blind and vision-impaired users have web-based catalogues that are equipped with a screen reader to provide them access to the library resources.

Table I shows that the majority of users (15; 60 per cent) in HKU and 11 (44 per cent) each at ADRC and DDCL responded that their library catalogue is not web-based, but it is equipped with a screen reader. In BL, the maximum number of users (44 per cent) responded that their library catalogue is web-based, but it is not equipped with a screen reader, which is again a barrier between the users and the resources. Finally, ten (40 per cent) users in the RNBTBL library stated that they are not aware whether their library catalogue is web-based or not, but it is equipped with a screen reader.

4.2 User's feedback regarding compatibility of screen readers
Screen readers act as an important tool to access information from the web by blind and vision-impaired users. The information on web pages/websites is represented in different forms, such as text, images, graphical and tabular form, which a screen reader is sometimes unable to read for users due to various technical reasons. Figure 2 represents user feedback regarding the degree of compatibility with the web of screen readers at the various locations.

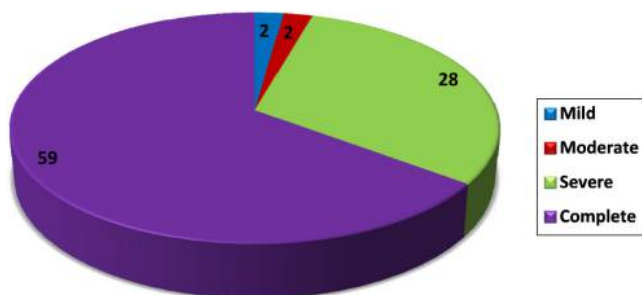**Degree of Blindness/Vision Impairment Suffered**

Figure 1.
Degree of blindness or vision impairment suffered by the respondents

Is the library catalogue web-based?	Library name				
	ADRC	DDCL	BL	HKU	RNBTBL
Yes					
Equipped with screen reader	–	–	–	4 (16%)	8 (32%)
Not equipped with screen reader	–	–	11 (44%)	–	–
No					
Equipped with screen reader	11 (44%)	11 (44%)	–	15 (60%)	–
Not equipped with screen reader	–	–	2 (8%)	–	–
Don't know					
Equipped with screen reader	–	–	–	–	10 (40%)
Not equipped with screen reader	9 (36%)	4 (16%)	5 (20%)	1 (4%)	–

Table I.
Web-based catalogue in the library with screen reader facility

Note: $n = 25$ (i.e. equal to 100%), representative population from each library

Compatibility of Screen Readers with the Web
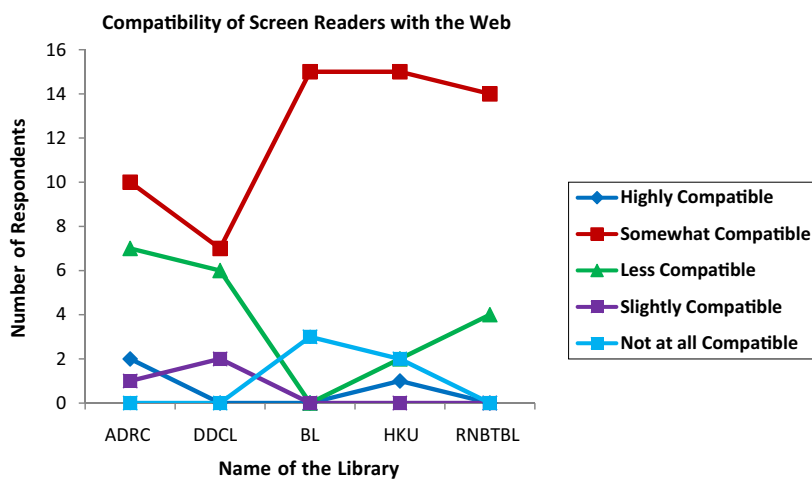
Note: $n = 25$ (i.e. equal to 100 per cent), representative population from each library

Figure 2.
Compatibility of
screen readers with
the web by library

It can be clearly seen from Figure 2 that the majority of users in all the libraries – that is, 60 per cent (15) each in BL and HKU, 56 per cent (14) in RNBTBL, 40 per cent (10) in ADRC and 28 per cent (7) in DDCL – responded that screen readers available today are "Somewhat Compatible" with the web. Figure 2 shows that the majority of users in all the libraries face problems during web access while using screen readers, which also indicates that screen readers available today for the blind and vision-impaired people are not completely compatible with the web.

4.3 Frequency of difficulty faced during web access
Blind and vision-impaired users can access the web with the help of assistive software on the basis of the degree of vision impairment suffered by them. However, sometimes, users face difficulty in accessing information from the web. This may be due to the reason that many screen readers available today are not completely compatible with the web. Thus, in this regard, Table II identifies the frequency of the difficulty faced by the users during web access with the help of assistive technology.

The responses of users shown in Table II indicate that the highest number of users in all the libraries – that is, 60 per cent (15) each in ADRC and BL, 56 per cent (14) each in HKU and

Frequency of difficulty faced	Library name				
	ADRC	DDCL	BL	HKU	RNBTBL
Very often	1 (4%)	1 (4%)	1 (4%)	1 (4%)	1 (4%)
Regularly	2 (8%)	2 (8%)	1 (4%)	2 (8%)	1 (4%)
Sometimes	15 (60%)	11 (44%)	15 (60%)	14 (56%)	14 (56%)
Once or twice	1 (4%)	–	–	1 (4%)	1 (4%)
Never	1 (4%)	1 (4%)	1 (4%)	2 (8%)	1 (4%)

Note: $n = 25$ (i.e. equal to 100%), representative population from each library

Table II.
Frequency of
difficulty faced
during web access
with assistive
technology

RNBTBL and, finally, 44 per cent (11) in DDCL – "Sometimes" face difficulty in accessing information from the web with the help of assistive software. Also, out of the total number of users in all the libraries, there is at least one user (4 per cent) in each library who "Very Often" finds it difficult to access the web even with the help of assistive technology.

4.4 Level of difficulty faced during access of the web
Blind and vision-impaired users sometimes face difficulty in accessing information from a web page, as some or part of the information on the page is presented in tabular format. This may be due to the reason that many screen readers do not provide the ability to assist with tables on web pages. Therefore, in this regard, Table III identifies the level of difficulty faced by users while accessing web-based information available in tabular format.

As shown in Table III, the majority of the users in RNBTBL (11; 44 per cent), ADRC (9; 36 per cent), DDCL (8; 32 per cent) and BL (7; 28 per cent) responded that they found it moderately difficult to access the information from web-based tables, as their screen readers are unable to read the information presented. In HKU, the highest number of users (6; 24 per cent) responded that it was very difficult for them to access web-based information presented in table format. Users with mild or moderate vision impairment found it slightly or not at all difficult to access the information from the web-based tables in all the libraries.

4.5 Library has accessible web page/website design
The accessibility of the library's web pages/website to people with disabilities means that they can easily perceive, understand, navigate and interact with the web pages/website without facing any barriers. Figure 3 presents the opinion of the users regarding the accessibility of the web pages/website of their library.

The majority of users in all the libraries – that is, 56 per cent (14) in HKU, 48 per cent (12) each in BL and RNBTBL and 36 per cent (9) in ADRC – stated that their library has accessible web page/website design, and they do not face any barrier while accessing it (Figure 3). Surprisingly, the majority of users in DDCL – i.e. 28 per cent (7) – responded that they have not yet accessed their library website, followed by 20 per cent (5) of users stating that their library has accessible website design.

### 4.6 User's recommendations for accessible webpage/website design
Web developers are responsible for accessible webpage/website design for people with disabilities. Most accessibility features can be easily implemented if they are incorporated at the beginning of website development or design. The accessibility of the website depends on various factors such as representation of the content, type of content and the size and

| | | Library name | | | |
Level of difficulty faced	ADRC	DDCL	BL	HKU	RNBTBL
Extremely difficult	–	1 (4%)	2 (8%)	3 (12%)	1 (4%)
Very difficult	6 (24%)	1 (4%)	6 (24%)	6 (24%)	4 (16%)
Moderately difficult	9 (36%)	8 (32%)	7 (28%)	4 (16%)	11 (44%)
Slightly difficult	1 (4%)	3 (12%)	2 (8%)	3 (12%)	1 (4%)
Not at all	4 (16%)	2 (8%)	1 (4%)	4 (16%)	1 (4%)

Note: $n = 25$ (i.e. equal to 100%), representative population from each library

Table III.
Level of difficulty faced during access/use of web-based tables
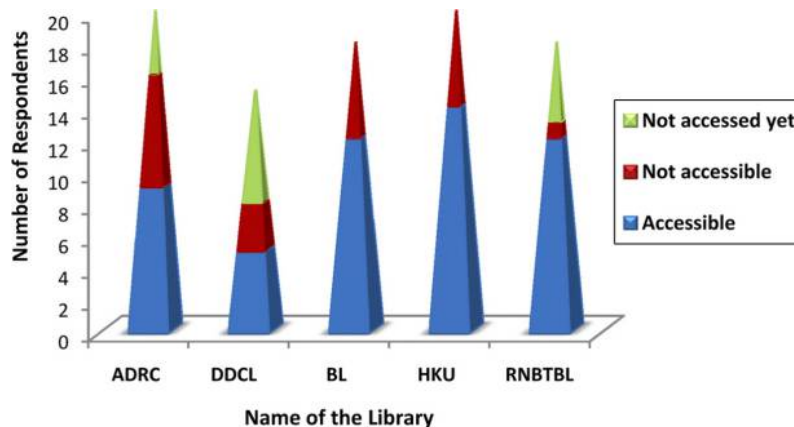
Note: $n = 25$ (i.e. equal to 100 per cent), representative population from each library

Figure 3.
Opinion of users
regarding the
accessibility of the
library's web
pages/website

complexity of the content, along with the compatibility of the website with access technology. Table IV focuses on the user's feedback regarding the various factors that need to be taken into consideration during web page/website development for better accessibility.

Table IV clearly shows that "Fewer graphics, less hyper-linking and less advertising to be easily read by screen readers" are the major factors among the maximum and highest number of respondents in ADRC (68 per cent), BL (40 per cent) and HKU (40 per cent) that need to be taken into consideration by web developers during website design.

			Library name		
User's recommendations	ADRC	DDCL	BL	HKU	RNBTBL
Web page/website should be interoperable with access technology	–	2 (8%)	3 (12%)	4 (16%)	–
Fewer graphics, less hyperlinking and less advertising to be easily read by screen readers	17 (68%)	5 (20%)	10 (40%)	10 (40%)	9 (36%)
Text content should be simple, readable and understandable	7 (28%)	8 (32%)	6 (24%)	6 (24%)	11 (44%)
Easily adjustable type sizes and colours	2 (8%)	4 (16%)	5 (20%)	4 (16%)	–
Use of graphs and tables along with alternative text	6 (24%)	1 (4%)	5 (20%)	7 (28%)	9 (36%)
All of the above	–	1 (4%)	4 (16%)	7 (28%)	1 (4%)
Any other (website should follow international standards)	–	1 (4%)	–	1 (4%)	–

Note: $n = 25$, where per cent exceeds 100%, as users were allowed multiple responses

Table IV.
User's
recommendations to
overcome barriers
faced during web
access

"Text content should be simple, readable and understandable" is the second major factor as perceived by the maximum number of users in RNBTBL (11; 44 per cent) and DDCL (8; 32 per cent) for accessible web page/website design.

5. Discussion, conclusions and suggestions

There are a variety of issues faced by blind and vision-impaired users in accessing the web-based resources of their library. Web-based catalogues can help vision-impaired users to access the information anywhere, anytime, by reducing their mobility problems. But the majority of blind and vision-impaired users – that is, 15 (60 per cent) in HKU and 11 (44 per cent) each in ADRC and DDCL – responded that their library catalogue is not web-based, and in BL, the maximum users – that is, 11 (44 per cent) – responded that their library catalogue is web-based, but it is not equipped with a screen reader, thus inhibiting maximum utilization of the library resources. The majority of blind and vision-impaired users in all the libraries – 60 per cent (15) each in BL and HKU, 56 per cent (14) in RNBTBL, 40 per cent (10) in ADRC and 28 per cent (7) in DDCL – responded that assistive technology, such as screen readers, available today are "Somewhat Compatible" with the web. In this regard, the study results show that the highest number of users in all the libraries – 60 per cent (15) each in ADRC and BL, 56 per cent (14) each in HKU and RNBTBL and, finally, 44 per cent (11) in DDCL – "Sometimes" face difficulty during their access of web information with the help of assistive technologies. It is also found that the majority of the users – 11 (44 per cent) in RNBTBL, 9 (36 per cent) in ADRC, 8 (32 per cent) in DDCL and 7 (28 per cent) in BL – responded that it is moderately difficult to access the information from web-based tables, as their screen readers are unable to read the information presented in tabular format on the web. Although it is found that the majority of users in all the libraries – 56 per cent (14) in HKU, 48 per cent (12) each in BL and RNBTBL and 36 per cent (9) in ADRC – do not face any barrier while accessing the web pages/website of their library, a majority of users – 68 per cent in ADRC and 40 per cent each in BL and HKU – demand that there should be "Fewer graphics, less hyper-linking and less advertising" to be easily read by screen readers for better accessibility of web pages/websites.

The survey results clearly state that there are barriers faced by blind and vision-impaired users in the libraries of Delhi, India, during their web access, even with the help of assistive technologies. These barriers need to be taken into consideration by the librarians and web developers to enhance and ensure maximum use of web resources. Access to web applications is an important issue for people with disabilities; thus, libraries should emphasize accessible web design for the disabled to access and use various online resources and services. "Advances in technology and use of the web have provided more choices in the delivery and access to information and resources" (Craven and Booth, 2006, p. 179) to the users and libraries. Today, libraries and their users rely heavily on electronic resources and databases for their information needs and requirements; therefore, it is essential that these resources be made accessible to users with disabilities along with other materials. Library websites are the digital front door to library services, as they reflect the priority that libraries give to their services (Power and LeBeau, 2009). Therefore, libraries should develop web pages/websites describing the services and facilities available for the blind and vision-impaired users in their particular library. In this regard, Vandenbark (2010) focused on mainly three types of web-based resources that can be offered by libraries to their user community:

(1)   access to the Internet;

(2)   access to subscription databases; and

(3)   a library's own web pages/website which needs to be accessible to people with disabilities.

Today, there is growing concern on the issue of accessibility in the community of librarians, web developers and people with disabilities. There is an urgent need to follow the laws and guidelines developed for accessible web design. An accessible website can help people with disabilities to participate more actively in society. The web offers the opportunity of unprecedented access to information and interaction for disabled people; moreover, the accessibility barriers to print, audio and visual media can be easily overcome through web technologies (Ioannidis *et al.*, 2006). Librarians can refer to guidelines established by the W3C, a well-known sponsor of global web development (Mates, 2010) and the standards-setting body of the Internet (Kerscher, 2001) to learn how to make web content easily accessible to people with disabilities, as these guidelines mainly focus on accessibility issues related to the content available through the web. Additionally, users with disabilities depend on the web for most of their information needs and requirements. Therefore, the impact of web-based resources needs to be evaluated through user-focused studies based on user preferences and the information-seeking behaviour of users in an academic and research environment for completing their tasks successfully. Due to the rising complexities in technologies, libraries of the future are tasked with an enormous amount of responsibility. The development of an effective communication network between the creators of information and the end-users will prove beneficial in adopting the new technologies by libraries in the modern digital environment. More detailed research on the various issues related to web accessibility is required, so that a "Web Information Retrieval Model" for people with disabilities can be developed. Additional studies of the compatibility with the web of available assistive software for blind and vision-impaired people will help libraries in selecting suitable software for their users, which will then reduce the technical barriers faced by blind and vision-impaired users during their access of the web.

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Further reading

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About the authors

Shailendra Kumar is an Associate Professor at the Department of Library and Information Science, University of Delhi, Delhi-110007, India. He has worked in American Library, Indian National Scientific Documentation Centre, Indira Gandhi National Open University. He has been working for the past ten years in the University of Delhi and has five years of teaching experience at Indian National Scientific Documentation Centre, Delhi, India. He received Young Information Scientist Award, Bharat Jyoti Award and Fellowship Award of Society for Information Science in 2008 in the field of Library and Information Science for working in e-Books and e-Learning system in LIS. He has supervised 12 research scholars for the award of PhD programme.

Gareema Sanaman is a PhD Research Scholar (UGC-JRF) at the Department of Library and Information Science, University of Delhi, Delhi-110007, India. She recently completed her PhD in the area of "Information Storage and Access for the People with Disabilities in the Digital Environment" and is a Research Scholar (UGC-JRF) in the Department of Library and Information Science, University of Delhi. She has worked on an automation project for one month in Ratan Tata Library, Delhi School of Economics, University of Delhi. She has received the Gold Medal in Library Science twice, i.e. in B.LI.Sc and M.LI.Sc. She has an MPhil from University of Delhi with Distinction marks (i.e > 75 per cent). Gareema Sanaman is a corresponding author and can be contacted at: gareema.sanaman@gmail.com