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Information Access Mechanism for Visually Impaired Students in Higher Educational Institutions: A Study

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ABSTRACT

The present study identified information access mechanisms for visually impaired students in select universities in Delhi, India. Study has ascertained the availability of information and communication technology (ICT) infrastructure in five major universities. The study applied purposive sampling method and collected data through a questionnaire from select universities. It was found that facilities for visually impaired students in higher educational institutions are very basic and it is difficult for visually impaired students to conduct study and research with existing ICT infrastructure. Higher educational institutions in Delhi do not have the infrastructure suited to the needs of visually impaired students to facilitate efficient services. University libraries in Delhi are facing difficulties due to lack of funds and trained staff to deliver services to visually impaired students. Library and information science professionals face inhibits in providing services to visually impaired students because of lack of suitable equipment(s), 'maintenance/updating of assistive software(s) and devices, time consuming scanning process and lack of awareness among visually impaired students about library resources and services.

Keywords: Information access; Visually impaired; Higher educational institutions; University library; Delhi, India

1. INTRODUCTION

More than one billion people i.e. approximately 15 per cent population worldwide suffer with some type of disability[1]. Approximately, 37 million people worldwide are blind, and nearly 15 million are from India[2]. Visually impaired students in higher educational institutions encounter several barriers in getting desired contents for study and research. Therefore, an inclusive environment ought to be provided to visually impaired students in order to develop a 'sense of belonging' among students with visual impairment. A supportive, welcoming and accepting atmosphere should be provided to them so that they feel comfortable[3,4]. Library professionals dealing with visually impaired students must have a sense of empathy because it influences effective communication and understanding between library professionals and users with special needs. Each library professional responsible to provide services to visually impaired students must learn empathic skills[5,6]. Library professionals must equip themselves with empathy so that they can help users with special needs to achieve their objectives in academic institutions. Therefore, LIS professionals should not only have good communication skills and empathy but also knowledge of using assistive tools and technologies, and awareness about the information needs of visually impaired students[7]. Over the years educational institutions have been admitting students with visually impairments. Therefore, it is the responsibilities of the universities to equip such individuals with the competencies required to attain key positions. However, in order to achieve these goals the educational institutions must comprehend the needs of people with visual impairment. Consequently, the library and information centres ought to be developed and equipped accordingly so that their needs can be met[8]. In addition, understanding the information needs of visually impaired students would also help to provide precise, relevant and comprehensive information to visually impaired students[9]. Specialised information services that ought to be provided to students suffering with print disabilities for equal opportunities, lifelong education and cultural enjoyment[10]. This would help visually impaired students to play an active role in the society.

University libraries must offer the range of information services to all students without discrimination[11,12]. The present study is an attempt to understand information access mechanisms available for visually impaired students in university libraries in Delhi. In addition, it aims to know the online services being provided to students with print disabilities and procurement methods being used by libraries for assistive tools and technologies. Study also ascertained the difficulties faced by library and information science professionals in managing information for people with visual impairment.

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2. LITERATURE REVIEW

Higher education is an intensively interactive social process and serves the purpose of imparting specific cognitive skills and providing relevant information. Its outcome crucially depends upon the ease with which a learner is able to interact with teachers, other students and institutional administrators, and access available information. On both the parameters, currently prevalent practices in higher education in India are extremely unfavourable for visually impaired students. Lourens and Swart[13] suggested that suitable mechanism pass on information daily events/programmes must be available in the institution so that a favourable environment can be created. Berggren[14], *et al.* stated academicians are not well equipped for inclusive teaching for visually impaired students. Oppenheim[15] developed an application of touch sensors embedded with audio tags. The technology was tested through a survey on normal and visually impaired users, and was found beneficial. Therefore, it is suggested to incorporate the same in commercial devices, and be coupled with smart phone for the benefit of visually impaired users so that they can use the complex unfamiliar devices conveniently.

Majinge[16] revealed that libraries in Tanzania are facing funds crunch to build the services for people with visual impairments. Shunmugam[17] highlighted that there are limited funds available for people who require special needs education in higher educational institutions in South Africa. Bodaghi and Zainab[18] described that lack of training for staff in academic libraries is a major reason that deputed staff find difficulties in handling assistive tools and technologies and providing services to people with visual impairments. Bateman[19], *et al.* found that many devices have been developed but not tested with visually challenged users. Therefore, it is suggested that libraries should procure assistive technologies after testing with users with print disabilities. Several studies endorsed that access to information for visually impaired students is a challenge because the information is not available in not suitable formats[20,21].

Moreover, only limited library websites are accessible to visually impaired students. Copeland[22] revealed that libraries contribute to the social construction of disability by not building websites accessible to the visually challenged. Besides this, attitude of library staff, lack of research, resources, and training facilities have been identified as inhibits to accessible services in libraries. Dim[23], *et al.* revealed that marking menus are faster than TalkBack. Further, suggested that marking menus along with motion gestures could assist in interacting with smartphone. Karabay[24] argues that visually impaired students face hindrances with readers and encoders services because of the inability of the reader to read clearly and smoothly. Furthermore, the study highlighted that readers provided to visually impaired students sometime unable to pronounce terms correctly if they are from a different discipline.

Günal[25] identified in his study that arrangement of the examination setting and inability of the examiner to manage it are major hindrance faced by students with print disabilities. Such students encounter problems in commuting because of lack of public transportation within the campus. Munyi[26] revealed that teaching Braille and print reading and writing would benefit a lot for people with low vision. Nzoka[27] studied proficiency of primary school teachers in English and Braille in special schools in Kenya and discovered lack of Braille skills among teachers. Ndung'u[28] described that 'Braille represents competence, independence and equality and Braille would always be a medium of literacy for persons with disability'. Visually impaired people largely depend on their hands and identify the surrounding by touching objects with cane. However, the coverage area using cane is limited and visually impaired persons collide and face hardship in daily routine in academic institutions[29,30]. To counter this problem a study by Cecílio[31], *et al.* proposed indoor systems namely BlinDroid that offer navigations assistance describes the places, products and services to the visually impaired. It detects the locations through signals from beacons that are pre-installed within the building. Nonetheless, the system has limitation that it does not work in case of absence of beacons in the building. Another study by Filpe[32], *et al.* demonstrated that visually impaired person using Microsoft Kinect sensor close to his or her chest can get appropriate image of the nearby area. Subsequently, the system mainly classifies the images into one of four categories namely no obstacle, obstacle ahead (wall), upstairs or downstairs. The images can be pre-processed in real time using neural network technique.

3. OBJECTIVES OF THE STUDY

The objectives of the study are as follows

- To ascertain the availability of special assistive devices and special assistive software(s) for visually impaired students
- To identify the problems being faced by library professionals in managing open access resources for people with visual impairments
- To identify the information services being provided to visually impaired students by libraries of universities in Delhi
- To ascertain inhibits faced by LIS professionals in providing the online library resources and services to visually impaired students
- To determine the materials being produced for visually impaired students by libraries of universities in Delhi
- To understand the requirements of libraries in developing online information system for visually impaired students.

4. METHODOLOGY AND SCOPE

Questionnaire method was used in data collection with purposive sampling technique. The questionnaire was prepared after a pilot study. The final questionnaire had 45 questions. Prior to circulation among librarians, reliability of the questionnaire was tested using statistical package for social sciences (SPSS) version 19. The questionnaire included dichotomous questions, multiple choice and open ended questions. The questionnaire is categorised in three sections wherein the first section seeks general information while the second related to awareness of library resources and services. The third section deals with the requirements of developing an online information system for visually impaired students. The questions are designed to elicit the experience of respondents about the following aspects:

- Improvement in services to visually impaired students in the last five years
- Availability of digital infrastructure to visually impaired students
- Types of online and other services being provided to visually impaired students
- Types of problems being faced by librarians in providing library resources and services
- The inhibits in managing open access resources for visually impaired
- Mode of consultations with visually impaired students
- Type of library material being produced for visually impaired students
- Availability of assistive hardware(s) and software(s)
- Components of orientation programme for visually impaired students
- Suitable online help and online training features for the proposed information system.

Responses to the questions were obtained visiting various universities during summer 2018. A scope of the study was limited to five major universities in Delhi viz., Jawaharlal Nehru University, New Delhi; University of Delhi, Delhi; Jamia Millia Islamia, New Delhi; and Indira Gandhi National Open University (IGNOU), New Delhi and Ambedkar University, Delhi. The questionnaires were filed by library professionals heading the visually impaired section in the university libraries. The responses were received from five universities. The collected dataset was analysed to achieve the objectives of the study. A simple percentage method was used to analyse the collected data. Results of data analysis are presented in figures and tables.

5. RESULTS AND ANALYSIS

The responses received through the questionnaire were analysed and presented in Tables and Figure.

5.1. Digital Infrastructure for Personal Use

A dichotomous question was asked whether sufficient digital infrastructure for visually impaired students is available in the institutions. Respondents were asked to reveal which equipment(s) their institutions provide personally to visually impaired students. It was found that none of the institutions in Delhi provides all nine equipment(s) listed in the question. University of Delhi provides five equipment(s) namely 'laptop', 'smart phone', 'talking book device', 'lecture recorder', 'hard disk', 'portal scanner', Internet can be accessed through Wi-Fi by visually impaired students. Jawaharlal Nehru University, New Delhi also provides five equipment(s) for personal use namely, laptop', 'talking book device', 'lecture recorder', 'portable hard disk' and 'portable scanner'. Response to the question by Jamia Millia Islamia revealed that university provides 'Internet through Wi-Fi', 'talking book device', 'hard disk to store data' and 'portable scanner'. It was found that Ambedkar University Delhi and Indira Gandhi National Open University provides the minimum ICT infrastructure personally to visually impaired students. These two universities provide only 'talking book device' and 'Internet through Wi-Fi' to visually impaired students.

5.2 Online Library Services

Questionnaire inquired about the type of online library services being provided to visually impaired students. Table 1 shows that IGNOU is the leading university in providing online library services to visually impaired students. It provides eight (100 %) services out of the eight listed online services viz. 'literature search', 'bibliography compilation', 'newspaper clippings', 'current awareness service', 'selective dissemination of information', 'information retrieval through internet', 'reference service', and 'document delivery service'. Jawaharlal Nehru University is the second leading university in providing university online library services and provides seven services out of the eight, followed by JMI provides four online services, and DU and AUD provide only two online services.

Table 1. Online library services being provided to visually impaired students

Online library services	JNU	DU	JMI	IGNOU	AUD
Literature search	✓	×	✓	✓	✓
Bibliography compilation	×	×	×	✓	×
Newspaper clippings	✓	×	×	✓	×
Current awareness service	✓	×	×	✓	×
Selective dissemination of information	✓	✓	×	✓	×
Information retrieval through internet	✓	×	✓	✓	✓
Reference service	✓	×	✓	✓	×
Document delivery service	✓	✓	✓	✓	×

Note: ✓means Yes and × means No.

5.3 Face-to-face Services being Provided to Visually Impaired Students

A question was asked to the respondent regarding services being provided to visually impaired students. Table 2 illustrates that DU is providing face-to-face services. DU provides seven services viz. 'ICT capability services', 'reference service', 'transcription service', 'talking dictionary', 'Braille translation', 'large print production', 'document delivery service', 'screen reading enabled library catalogue' followed by JNU which provided seven services out of the eight listed in the table, JMI provides six services, IGNOU also provides the six services. The lowest number of face-to-face services are being provided by AUD i.e. 4 services.

5.4 Inhibits Faced by LIS Professionals in Providing Online Resources and Services

Libraries in higher educational institutions encounter several problems in delivering services to visually impaired students. Nawe[33] elaborated that fund crunch is a major problem with libraries worldwide providing services to visually impaired. Brophy and Craven[34] explained that library information technology (IT) systems and interfaces must be user-friendly so that people with visual impairment can read and interact conveniently. Table 3 depicts inhibits faced by

Table 2. Face-to-face services to visually impaired students

Library Service(s)	JNU	DU	JMI	IGNOU	AUD
ICT capability services	✓	✓	✓	✓	✓
Reference service	✓	✓	×	✓	✓
Transcription service	×	✓	×	×	×
Talking dictionary	×	✓	✓	×	✓
Braille translation	✓	✓	✓	×	×
Large print production	✓	✓	×	✓	×
Screen magnifiers	✓	×	✓	✓	×
Document delivery service	✓	✓	✓	✓	×
Screen reading enabled library catalogue	✓	✓	✓	✓	✓

Note: ✓means Yes and × means No.

Table 3. Inhibits faced by LIS professionals

Inhibit(s) faced	JNU	DU	JMI	IGNOU	AUD
Lack of funds	×	✓	✓	×	
Trained staff to deliver services	×	✓	✓	✓	✓
Suitable equipment(s)	×	✓	✓	✓	✓
Attitude of visually impaired users	×	✓	×	×	×
Maintenance/updating of assistive software(s) and devices	✓	✓	×	×	×
Unstandardized open access resources	×	✓	×	×	×
Less number of resources compliant with standards	×	×	✓	×	×
Lack of cooperation of authorities	×	×	×	×	×
Time consuming scanning process	✓	✓	×	×	×
Disseminating the information about resources/services among VI users	×	×	×	×	×
Poor internet connectivity	×	×	×	×	×
Lack of awareness about the ICT facilities among VI students	✓	✓	×	×	×
None of the barriers faced	×	×	×	×	×

Note: ✓means Yes and × means No.

library professionals of higher educational institutions in Delhi. Interestingly, none of the problems is common in all five libraries. DU library has listed the maximum inhibits being faced such as, 'lack of funds', 'trained staff to deliver services', 'suitable equipment(s)', 'Attitude of visually impaired users', 'maintenance/updating of assistive software(s) and devices', 'time consuming scanning process' , 'awareness among VI students about library resources and services'. JMI listed four inhibits viz. 'lack of funds', 'trained staff to deliver services', 'suitable equipment(s)', and 'less number of resources compliant with standards'. JNU listed three hindrances i.e. 'Maintenance/updating of assistive software(s) and devices', 'time consuming scanning processes, 'lack of awareness of library resources and services among VI students'. IGNOU and AUD listed two common problems i.e. 'trained staff to deliver services' and 'suitable equipment(s)'.

5.5. Difficulties in Managing Open Access Resources

The Study also identified problems faced by university libraries in managing open access resources for visually impaired students. Table 4 shows that no problem is listed as common among five universities. Moreover, four universities except JNU stated that 'interface of open access resource is not designed as per VI students' is the major problem. JNU, DU and JMI libraries mentioned that open access resources are incomplete. Two libraries namely JNU and IGNOU indicated that open access resources are not updated regularly which is another problem faced by libraries in managing open access resources. Only one library i.e. JNU stated open access resources are not organised properly. Only DU opined that open access resources are less user-friendly.

Table 4. Difficulties in managing open access resources

Problem(s)	JNU	DU	JMI	IGNOU	AUD
Less user-friendly	×	✓	×	×	✓
Incomplete resources	✓	✓	✓	×	×
Interface not designed as per VI students	×	✓	✓	✓	✓
Not updated regularly	✓	×	×	✓	×
Not organised properly	✓	×	×	×	×

Note: ✓means Yes and × means No.

5.6 Procurement methods for Assistive Tools and Technologies

A question was posed in the questionnaire to understand the method of procuring assistive tools and technologies for visually impaired students. It was asked whether the libraries consult the visually impaired students prior to procurement of assistive tools and technologies for them. The responses were analysed and dataset shows that all the libraries (100 %) consult the visually impaired students prior to procure the assistive tools and technologies for them. All libraries (100 %) follow the group discussion method and all the libraries excluding AUD indicated that demonstration of tools and technology is another method they follow prior to procuring assistive tools and technologies. Trial method is also being followed by all the libraries except DU. Lecture method is being followed by JNU, DU and IGNOU. Consultation through e-mail is done by JNU, DU and IGNOU. Seeking suggestions through library website is also followed by JNU, DU and IGNOU. Disseminating Information and seeking response through notice board is only followed by DU.

Table 5. Method of procuring assistive tools and technologies

Method(s)	JNU	DU	JMI	IGNOU	AUD
Group discussion	✓	✓	✓	✓	✓
Demonstration of technology	✓	✓	✓	✓	×
Trail method	✓	×	✓	✓	✓
Lecture method describing features of product(s)	✓	✓	×	✓	×
Consultation through email	✓	✓	×	✓	×
Information through notice board	×	✓	×	×	×
Suggestions through library website	✓	✓	×	✓	×

Note: ✓means Yes and × means No.

5.7 Collection Development Policy and Communication Methods

The study establishes collection development method for visually impaired students in the libraries of five major universities in Delhi. It was found that all the universities procure books on the basis of demand of visually challenged students. Only JMI highlighted that they also procure on the basis of publishers' catalogue. Three libraries viz. DU, JMI and IGNOU mentioned that they procure on the basis of reviews from various sources. Interestingly, no library mentioned that they accept donation in building collection for visually impaired students. Furthermore, it ascertained the communication methods of libraries to reach the visually impaired students. It was identified that communication through mobile is most popular among libraries to reach the visually impaired students. All the university libraries (100 %) stated that they reach the visually impaired students through mobile communication. Similarly, 100 percent libraries mentioned they communicate through personal meeting with visually impaired students. E-mail method is followed by all the libraries except AUD. Postal correspondence is being used only by IGNOU to reach the visually impaired students.

5.8 In-house Material Produced by the Library

A question was asked in the questionnaire to reveal the in-house material being produced by them for visually impaired students. Responses were analysed and it was found that JNU is producing only Braille books and provide scanned book in text, rich text format (RTF) and portable document format (PDF). DU provides Braille books, books scanned in digital accessible information system (DAISY) format, books in electronic publishing (EPUB) format through outsourcing agency. In addition, DU library also provide talking books in DAISY format to visually impaired students of the university. JMI provides talking books, scanned magazines in DAISY format, and scanned books in DAISY format to visually impaired students. IGNOU only offers Braille books and talking books in DAISY format and AUD provides no in-house material to visually impaired students.

Table 6. ICT based services to visually impaired students

ICT based Services	JNU	DU	JMI	IGNOU	AUD
Screen reader compliant Web OPAC	✓	×	✓	×	✓
Instant chat	×	×	×	✓	×
Remote access of e-resources	✓	✓	✓	✓	✓
Single Sign-in	✓	✓	×	✓	
Online book requisition	×	✓	×	✓	✓
Document delivery Services	✓	✓	✓	✓	×
Retrieval of material from databases	✓	×	×	✓	×
Braille print out of e-book (s)	✓	✓	×	✓	×
Mobile app services	×	✓	×	×	×
ICT training	✓	✓	✓	✓	✓
Total	7	7	4	8	4

Note: ✓means Yes and × means No.

5.9 Advanced ICT Based Services

Advanced digital services are crucial for visually impaired students in studies and research. Bhardwaj and Kumar[35] found college websites are not designed according to the accessibility standards. Thus, it is cumbersome to access information for visually challenged students. Michalska[36], et al. confirmed that majority of websites are not accessible to people with visually disability. Hence, guidelines ought to be prepared for web content accessibility. A question was asked in the questionnaire to identify digital services provided to visually impaired students. Table 6 illustrates that IGNOU is providing advanced ICT based services. IGNOU has been providing 8 services out of the 10. It is ranked no 1 with score of 80 per cent, followed by JNU and DU which provides 7 out of the 10 services listed. JMI and AUD revealed that they provided 4 services and their score is 40 percent each.

Furthermore, it was found that all the universities have computer lab for visually impaired students. The number of computers in the labs for visually impaired was identified. Figure 1 shows the number of terminals in their lab. JNU is the leading university library which 20 computers in the lab, followed by DU (19), JMI (7). Remaining, two universities have only 2 personal computers (PCs) each in their computer labs for visually impaired students.

5.10 Availability of Assistive Equipment(s) in Institutions

Bodaghi and Zainab[37] pointed out that academic libraries do not have suitable assistive technologies to assist visually challenged students especially to convert print to Braille and recorder to create audio corrections. Carson[38] pointed out the case of people with visual impairment facing inhibits in using the information resources in alternative format such as, large text, braille books, audio books, and suggested that these should be provided to them. Table 7 shows that JMI is the leading institution and it has 8 equipment(s) out of the total 23 listed, followed by

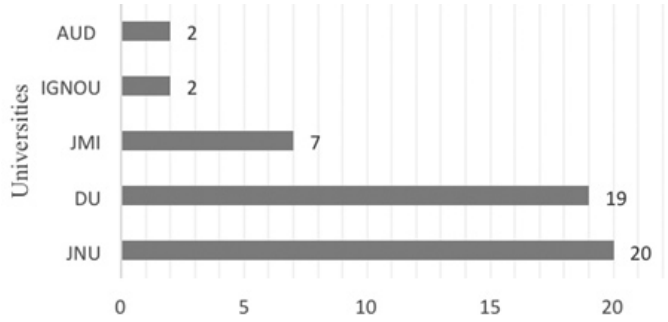

Figure 1. Number of computers in labs for visually impaired.

Table 7. Availability of assistive equipment(s)

Assistive equipment(s)	JNU	DU	JMI	IGNOU	AUD
Screen magnifiers	✓	×	✓	✓	×
Kurzweil reading machine	✓	×	×	×	×
Braille printer	✓	✓	×	✓	×
Zoom X scanner	×	×	×	×	×
Flatbed scanner	✓	×	×	✓	×
Overhead scanner	×	×	×	×	×
Sonic guide	×	×	×	×	×
Hand-held scanner	×	✓	✓	×	×
Voice eyes	×	×	×	×	×
RUBY	×	×	✓	×	×
LEX Cam scanner	✓	×	×	×	×
SARA CE	×	×	×	×	×
Speech Synthesis	✓	×	×	×	×
Digital voice recorder ICU-UX70	✓	✓	✓	×	×
Reading edge	×	×	×	×	×
Heavy lenses	×	×	×	×	×
Readlt Wand	×	×	✓	×	×
Eye-C Handheld Video magnifier	×	×	✓	×	×
Keyboard Overlay	×	×	×	×	✓
Braille Typewriter	×	✓	×	×	×
Talking Scientific Calculator	×	×	✓	×	×
Plextalk PTR2	×	×	✓	×	×
Magnifying Glasses	×	×	×	✓	×
Total (23)	7	4	8	4	1

Note: ✓means Yes and × means No.

JNU (7), DU, and IGNOU (4) equipment(s) each. AUD has only one equipment out of the 23 listed. Therefore, the availability of assistive equipment(s) in higher educational institutions in Delhi is discouraging. It is cumbersome for visually impaired students to do study with ease using very basis facilities in universities. It shows that authorities in these institutions are not spending sufficient funds to build the necessary infrastructure for visually impaired students.

5.11 Availability of Assistive Software(s)

Sarı[39] expressed that visually impaired students not benefited from library because library resources because libraries do not arrange the tools according to disability and embossed documents. Therefore, libraries in higher educational institutions must arrange tools and resources accordingly to disability of users and should offer a variety of services for students with special needs. Students' suffering from visual disability must be provided services in same way as normal students[40]. Respondents were asked to reveal the availability of assistive software(s) in higher educational institutions in Delhi. Table 8 shows that JMI has the highest number of assistive software(s) 8 out of 18 listed in the Table viz. SAFA Reader, Open Book, Read Easy+, JAWS Screen Reader, Vaachak, Magic Prof Magnification, Talking Typing Teacher, Infity Reader and Chatty Infty. DU is the second and has 5 assistive software(s), followed by JNU (4), AUD (2). IGNOU has only one assistive software(s) namely JAWS Screen Reader.

Table 8. Availability of assistive software(s)

Assistive Software(s)	JNU	DU	JMI	IGNOU	AUD
Talk and Zoom	×	×	×	×	×
Talk Backs	×	×	×	×	×
Hindi OCR	✓	✓	×	×	×
OBI DAISY	×	✓	×	×	✓
SAFA Reader	×	×	✓	×	×
Open Book	×	×	✓	×	×
Read Easy+	×	×	✓	×	×
Lasecan	×	×	×	×	×
AMIS	×	×	×	×	×
OBR Braille Scanning	×	✓	×	×	×
Kurzweil	✓	×	×	×	×
ABBYY Fine Reader	×	×	×	×	×
JAWS Screen Reader	✓	✓	✓	✓	✓
Vaachak	×	×	✓	×	×
Magic Pro. Magnification	✓	×	✓	×	×
Dux Bury	×	✓	×	×	×
Talking Typing Teacher	×	×	✓	×	×
Infity Reader and Chatty Infty	×	×	✓	×	×
Total (18)	4	5	8	1	2

Note: ✓means Yes and × means No.

5.12 Orientation Programme and its Scope

Library orientation has significant impact in usage of library sources and services. More importantly, visually impaired students can benefit immensely if orientation programmes are conducted systematically. Therefore, a dichotomous question was asked to know whether the library conduct orientation programme for visually impaired students or not. It was found that all the libraries conduct orientation programme for visually impaired students. Further, it was asked to specify the components of orientation programme such as, assistive software(s), assistive hardware(s), library resources, library services, library tour, library rules and regulations, open access resources and usage of library catalogue. It was found

that JNU, DU, JMI and IGNOU cover all the components in the orientation programme. A assistive hardware(s), library tour are not included in the orientation of AUD.

The third section of the questionnaire is related to the requirements of information system for visually impaired students. Therefore, it was attempted to understand what kind of information system is required for visually impaired students.

5.13 Contents to be Incorporated in ISVI

Responses were sought to understand the type of materials to be incorporated in information system for visually impaired (ISVI). The responses were analysed and it was found that E-books and E-Magazines are the most preferred material. All the five university libraries asked to include these two types of contents. In addition, all the respondents stated that they need that information on the notice board must be included in the ISVI. Four universities namely JNU, DU, JMI, and IGNOU advocated to include E-syllabi and question papers. News are also useful information which visually impaired students need on daily basis. Thus, it was asked by all the universities except JMI to include news in the information system. JNU, DU and IGNOU libraries responses also suggested including research articles in the information system. JNU and DU libraries asked to incorporate scholarship details, audio contents, books review in the proposed information system for visually impaired students.

5.14 Help Features

Study also ascertained help features to be included in the ISVI. A multiple choice question was asked giving five choices viz., peer help, online chat, help of librarian online, frequent asked questions (FAQs), E-mail and discussion forum. It was found that all the five universities libraries responses except JMI demand to have e-mail communication with students in ISVI. Four libraries namely JNU, JMI, IGNOU, AUD responses asked to include 'online chat' in the proposed system. In addition, IGNOU and AUD wished to have FAQ facility in the system. Three university libraries namely JMI, IGNOU and AUD advocated to have 'online librarian help' feature in the ISVI.

5.15 Online Training

Another dichotomous question was posed to know whether to include online training or not in the ISVI . Respondents were asked to choose the mode of online training for the proposed ISVI and four options were indicated viz. 'email', 'online tutorial', 'instant chat', and 'multimedia contents'. Table 9 illustrates that 'online tutorial' is the most preferred mode of online training as suggested by respondents. Except AUD all the respondent libraries opted to include the same in the proposed ISVI. Email is preferred by three university libraries namely JNU, DU and IGNOU. JMI and IGNOU advocated for inclusion of 'multimedia contents' for online training for visually impaired students. 'Instant chat' is suggested by IGNOU library to incorporate in online training for ISVI.

Table 9. Online training

Online Training	JNU	DU	JMI	IGNOU	AUD
E-mail	✓	✓	×	✓	×
Online Tutorial	✓	✓	✓	✓	×
Instant Chatting	×	×	×	✓	×
Multimedia Contents	×	×	✓	✓	✓
Total (4)	2	2	2	4	1

Note: ✓means Yes and × means No.

6. DISCUSSIONS AND CONCLUSIONS

Visually impaired students face difficulties in socializing and seeing value in the social environment with other students in higher educational institutions. Low self-confidence is major cause for this problem. Since, visually impaired students' face difficulties in traveling others and reaching at the right place at right time are this posing a challenge in socializing with others[41]. JNU is found to be the leading university and it provides seven out of eight online services listed in the questionnaire, followed by JMI providing four online services, and DU and AUD provide only two online services to visually impaired students. It is apparent that libraries in higher educational institutions have not updated their services. Only three universities provide selective dissemination of information (SDI) service to their visually impaired students. Study found that only two universities namely JNU and IGNOU organise specialised orientation programmes and library tour. This shows lack of seriousness of the remaining three universities in providing services to visually impaired students.

Furthermore, study found DU and IGNOU facilitate their students with volunteer readers. Three universities do not have such service and it is apparent that they are failing to channelise the help of other students to the community. All the libraries have provision of inter library loan (ILL) facility. Nevertheless, visually impaired students may not be aware of such services. Thus, libraries ought to organise meeting with students on periodic basis to disseminate the information about services and resources. The education process is difficult for visually impaired because of their requirements for various devices[42]. Unstandardised websites are difficult to access with any kind of assistive technology. Therefore, it is the responsibility of librarians to develop websites keeping in mind the needs of visually impaired students so that these websites can be accessed with ease using assistive technologies. Main problems being faced by librarians in providing services are funds crunch, trained staff to deliver services, lack of suitable equipment(s), and maintenance/updating of assistive software(s) and devices. In addition, scanning is a time consuming process and this because major difficult in the absence of suitable manpower. Study also found that visually impaired students are less aware about library resources and services. Consequently, library resources and services are not being used optimally by visually impaired students. It was found that JMI is the leading institution and it has eight equipment(s) out of the total twenty three listed. Remaining libraries have JNU (7), DU and IGNOU (4) equipment(s) each. Surprisingly, AUD has only one equipment out of the 23 listed. It shows that infrastructure for visually impaired students in higher educational institutions is

pathetic. Academic libraries in Delhi also have limited assistive software(s) and it found that JMI has the highest eight assistive software(s). DU has five assistive software(s), followed by JNU (4), AUD (2). IGNOU has only one assistive software(s). Indian libraries lag far behind in providing advanced ICT based services, procuring assistive equipment(s) and assistive software(s) for visually impaired students compared to western libraries. The study will be useful to understand the present situation of higher education institution libraries providing services to visually impaired students. The findings will be useful to authorities of higher educational institutions, funding agencies, policy makers to develop infrastructure in academic libraries for visually impaired students. Accredited and funding agencies can also utilise the findings of the study in accreditation and grading of higher educational institutions. Besides this, designers of open access and commercial IT resources can also benefit from the study to make the resources complaint with assistive tools and technologies.

REFERENCES

1. World Report on Disability, 2011, accessible at: http://www.who.int/disabilities/world_report/2011/report/en/ (accessed on 1 July 2018)
2. Times of India. India has largest blind population, 2007. http://timesofindia. indiatimes.com/india/India-has-largest-blind-population/articleshow/2447603.cms (accessed on May 18, 2018)
3. Peters, S.J. A historical analysis of international inclusive education policy and individuals with disabilities. *J. Disability Policy Stud.*, 2007, **18**(2), 98-108. doi: 10.1177%2F10442073070180020601
4. Symeonidou, S. & Phtiaka, H. Using teacher's prior knowledge, attitudes and beliefs to develop in service teacher education courses for inclusion. *Teach. Teach. Educ.*, 2009, **25**(4), 543–550. doi: 10.1016/j.tate.2009.02.001
5. Nikolova, M.I. Love it! Developing psychological skills to become a better librarian, 2004. http://www.liscareer.com/nikolova_psych.htm. (accessed on 30 August, 2018).
6. Bodaghi, N.B.; Cheong, L.S. & Zainab, A.N. Librarians empathy: visually impaired students' experiences towards inclusion and sense of belonging in an academic library. *J. Acad. Libr.*, 2016, **42**(1), 87-96. doi: 10.1016/j.acalib.2015.11.003
7. Miller, F. & Wallis, J. Social interaction and the role of empathy in information and knowledge management: A literature review. *J. Educ. Libr. Info. Sci.*, 2011, **52**(2), 122-132.
8. Mutula, S. & Majinge, R.M. Information behaviour of students living with visual impairments in University Libraries: A review of related literature. *J. Acad. Libr.*, 2016, **42**(5), 522-528. doi: 10.1016/j.acalib.2016.06.019
9. Rugeyasila, A.A. Information needs and Seeking behavior of pupils with visual impairments of Uhuru Mchanganyiko primary school in Dar es salaam, Tanzania. Dar es Salaam: 2013. University of Dar es Salaam (MA dissertation).
10. Yoon, H. & Kim, S. On the improvement of the copyright law of Korea for library services for persons with disabilities. *J. Libr. Info. Sci.*, 2012, **45**(2), 140–152. doi: 10.1177%2F0961000612457106
11. Yoon, H. & Kim, S. Development strategy of the alternative format materials for disabled people in Korea. *Aslib Proceedings: New Information Perspectives*, 2011, **63**(1), 380–398. doi: 10.1108/00012531111148976
12. Todaro, A.J. Library services for people with disabilities in Argentina. *New Libr. World*, 2005, **106**(1212/1213), 253–268. doi: 10.1108/03074800510595869
13. Lourens, H. & Swartz, L. Experiences of visually impaired students in higher education: bodily perspectives on inclusive education. *Disability & Society*, 2016, **31**(2), 240-251. doi: 10.1080/09687599.2016.1158092
14. Berggren, U.J.; Rowan, D.; Bergbäck, E. & Blomberg, B. Disabled students' experiences of higher education in Sweden, the Csech Republic, and the United States–a comparative institutional analysis. *Disability Society*, 2016, **31**(3), 1-18. doi: 10.1080/09687599.2016.1174103
15. Oppenheim , M. Speech and touch enhanced interface for visually impaired users. *J. Assistive Technol.*, 2013, **7**(3), 149–159. doi: 10.1108/JAT-11-2012-0038
16. Majinge, R.M. Library services provision for people with visual impairment and in wheelchairs in academic libraries in Tanzania. Pietermaritzburg: 2014. University of KwaZulu-Natal, PhD Thesis.
17. Shunmugam, M. An exploration of the barriers, as experienced by visually impaired students studying at the University of Natal. Durban. 2002. University of Natal. M.A. Dissertation.
18. Bodaghi, N.B. & Zainab, A.N. Accessibility and facilities for the disabled in public and university library buildings in Iran. *Information Development*, 2012, **29**(3), 241–250. doi: 10.1177%2F0266666912461265
19. Bateman, A. et al. A user-centered design and analysis of an electrostatic haptic touchscreen system for students with visual impairments. *Int. J. Human-Comput. Stud.,* 2018, **109**, 102–111 doi: 10.1016/j.ijhcs.2017.09.004
20. Chitereka, C. People with disabilities and role of social workers in Lesotho. *Int. Online J.*, 2010, **8**(1), http://www.socwork.net/sws/article/view/55/69) (accessed on July 1, 2018.
21. Seyama, L.G. Information seeking behaviour of students with visual impairments: A case study of the of KwaZulu-Natal. 2009. Pietermaritzburg. Master's dissertation. Of KwaZulu-Natal).
22. Copeland, C.A. Library and information center accessibility: The differently-able patron's perspective. *Tech. Serv. Q.*, 2011, **28**, 223–241. doi: 10.1080/07317131.2011.546281
23. Din, N.K.; Kim, K. & Ren, X. Designing motion marking menus for people with visual impairments, *Int. J. Human-*

Comput. Stud., 2018, **109**, 79-88.
doi: 10.1016/j.ijhcs.2017.09.002

24. Karabay, E. Comparison of the effects of live reader and computer-aided reading on test achievement of visually impaired students. Unpublished doctoral dissertation. Ankara University Institute of Educational Sciences, Measurement and Value, 2016, Ankara
25. Günal, Yurdagül. Academic and social problems faced by visually impaired students during University Education. *J. Educ. Pract.*, 2017, **8**(17), 144-149.
26. Munyi, Chomba M. Wa, Literacy for students with low vision in special schools: Perceptions of teachers on instructional media in Kenya. *J. Educ. Pract.*, 2018, **9**(3), 24-28.
27. Nzoka. Establishing Braille proficiency levels among primary school teachers of learners who are blind in Kenya. 2011. Kenyatta University, *unpublished Ph.D. thesis*
28. Ndung'u, R.R. Literacy medium for learners with visual impairment: Primary literacy medium used by secondary school learners with low vision in Kenya. 2011. University of Oslo, Norway, *Unpublished Thesis*.
29. Lee Y.H & Medioni, G. Wearable RGBD indoor navigation system for the blind. *In* Computer vision - ECCV 2014 workshops, edited by Agapito L, Bronstein MM, Rother C, 2014. Zürich, Switserland. Heidelberg Sept 6–12. Springer; 2014. 493–508
doi: 10.1007/978-3-319-16199-0_35
30. Fiannaca, A.; Apostolopoulous, I. & Folmer, E. Headlock: A wearable navigation aid that helps blind cane users traverse large open spaces. *In* Proceedings of the 16th international ACM SIGACCESS conference on Computers & accessibility, ACM. 2014. 19-26.
doi: 10.1145/2661334.2661453
31. Cecílio, J.; Duarte, K. & Furtado, P. BlindeDroid: An information tracking system for real-time guiding of blind people. *Procedia. Comput. Sci.*, 2015, **52**, 113–20.
doi: 10.1016/j.procs.2015.05.039
32. Filipe, V.; Fernandes, F.; Fernandes, H.; Sousa, A.; Paredes, H. & Barroso, J. Blind navigation support system based on Microsoft Kinect. *Procedia. Comp. Sc.*, 2012, **14**, 94–101.
doi: 10.1016/j.procs.2012.10.011
33. Nawe, J. Strategies for financing public university libraries in Tanzania. University of Dar es Salaam, *Lib. J.*, 2007, **9**(2), 1–19.
doi: 10.4314/udslj.v9i2.26671
34. Brophy, P. & Craven, J. Web accessibility, *Library Trends*, 2007, **55**(4), 950–972
doi: 10.1353/lib.2007.0029
35. Bhardwaj, R.K. & Kumar, S. A comprehensive digital environment for visually impaired students: User's perspectives. *Libr. Hi. Tech.*, 2017, **35**(4), 542-557.
doi: 10.1108/LHT-01-2017-0016
36. Michalska, A.M.; You, C.X.; Nicolini, A.M.; Ippolito, V.J. & Fink, W. Accessible web page design for the visually impaired: a case study. *Int. J. Human-Comp. Interact.*, 2014, **30**(12), 995-1002.
doi: 10.1080/10447318.2014.925771
37. Bodaghi, N.B. & Zainab, A.N. Accessibility and facilities for the disabled in public and university library buildings in Iran. *Inf. Dev.*, 2012, **29**(3), 241–250.
doi: 10.1177%2F0266666912461265
38. Carson, G. The social model of disability. Scotland: Scottish accessible information forum. 2009. http://www.ukdpc.net/site/images/library/social%20of20disability2.pdf (accessed on 3 July 2018).
39. Sarı, H. Studying at Selcuk University handicapped and vision problems faced by students with disabilities and contemporary suggestions for the solution. Selcuk University Journal of Social Sciences Institute, 2005, **13**, 335-355.
40. Aydın, A. A research on the knowledge access problems of visually impaired university students, Bilgi Dünyası, 2012, **13**(1) 93-116
41. Dursin, A.G. Information design and education for visually impaired and blind people. *Procedia-Social Behav. Sci.*, 2012, **46**, 5568-5572.
42. Gomes, G.; Duarte, C.; Coelho, J. & Matos, E. Designing a facebook interface for senior users. *Sci. World J.*, 2014, 1-8. http://downloads.hindawi.com/journals/tswj/2014/741567.pdf (accessed on 19 March, 2018).
doi: 10.1155/2014/741567.

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