

USE OF ASSISTIVE TECHNOLOGIES FOR VISUALLY IMPAIRED PERSONS TO ACCESS ACADEMIC LIBRARY RESOURCES

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ABSTRACTS

This study explores the role of assistive technologies in libraries to improve access to resources for people with visual impairments. It discusses various types of assistive technologies, applications, focusing on their functionalities and uses. The paper addresses the challenges of implementation and strategies to overcome them while also highlighting the positive effects of assistive technologies on accessing library resources. It stresses the necessity of raising awareness and offering training for both library personnel and patrons. The significance of assistive technologies in fostering inclusive library settings is underscored, and a framework for their implementation in libraries is provided, along with suggestions for future research. It highlights how assistive technologies impact access to library resources based on relevant studies. Emphasis is placed on the importance of awareness and training initiatives for library staff and users alike. The paper concludes with a summary of the key findings and proposes directions for future research. By acknowledging the role of assistive technologies, libraries can create inclusive spaces that support visually impaired persons and promote equal opportunities for information access and discovery.

Keywords: Assistive technologies, adaptive technologies, visual impairment, technologies for visually impaired persons.

1. INTRODUCTION

Access to information is one of the fundamental human rights, enabling individuals to grow and engage actively within society. Persons with disabilities exist in every society. Therefore, persons with disabilities possess equal rights to pursue higher education and access to library resources.

Libraries should fulfil the needs of every user irrespective of their category. Among the various groups, one significant population is that of visually impaired persons. The term 'visually impaired' generally refers to individuals who are partially sighted or fully blind. The World Health Organization (WHO) estimates that around 1.3 billion people globally have vision impairments, including about 188.5 million with mild issues. Estimates indicate that around 217 million people have ordinary to severe vision impairment, nearly 36 million individuals are completely blind, and 826 million suffer from near vision impairment.

The Census of India 2011 reports that 26.81 million disabled people represent 2.21 percent of the nation's population. Among them, 5.03 million people experience visual impairments, which represent 18.77 percent of the total disabled population in the country. It is estimated that the number of people with disabilities in India rises by about 5 million each year. Visually

impaired individuals encounter numerous obstacles in accessing information comparable to the privileges experienced by their peers. Assistive technologies provide autonomy by allowing visually impaired person to accomplish tasks that were previously beyond their reach. These technologies can significantly enhance the quality of life for visually impaired person by improving their access to information, knowledge, education, healthcare, and employment (UNESCO, 2006).

2. DISABILITY LAWS AND ACTS AT THE INTERNATIONAL AND NATIONAL LEVEL

The WHO Conventions on the Rights of Persons with Disabilities (CRPD) outlines the civil, cultural, political, social, and economic rights of people with disabilities (United Nations, 2006). The member states that have signed the convention are bound to promote, protect, and ensure the full and equal enjoyment of the human rights and fundamental freedoms of people with disabilities and promote respect for their inherent dignity.

The Equality Act 2010 (UK Parliament) provides protection against discrimination and promotes equality of opportunity for people who are disabled in the United Kingdom.

The Americans with Disabilities Act of 1990 and ADA Amended Act of 2008 as amended (including the changes made by ADA Amended Act of 2008) prohibits discrimination and ensures equal opportunity for persons with disability in employment, state local government services, public accommodation, community facilities, and transportation.

India has offered substantial support to individuals with disabilities through measures such as enacting a Special Act, implementing a 'National Policy for Persons with Disabilities', and providing reservations in education, employment, and government initiatives, while also establishing various institutes and organizations. Beyond the legal framework, significant infrastructure has been developed, including the 'National Institute of Visually Handicapped' in Dehradun. The Government of India has introduced three key legislations for individuals with disabilities:

- 1) 'The Right of Persons with Disabilities Act, 2016', which replaces the 'Persons with Disability (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995', ensures equal rights in education, employment, and the creation of a barrier-free environment as well as social security.
- 2) The National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation, and Multiple Disabilities Act, 1999 includes provisions for legal guardianship for these four categories and aims to foster an enabling environment for as much independence as possible.
- 3) The Rehabilitation Council of India Act, 1992 focuses on developing trained personnel to provide rehabilitation services (MSJE 2009).

Furthermore, in the higher education sector, the University Grants Commission (UGC) is encouraging universities and colleges across the country to engage in special education initiatives to empower individuals with disabilities. The UGC has initiated a program to assist

universities and colleges in facilitating Higher Education for Persons with Special Needs (HEPSN).

1. REVIEW OF THE LITERATURE

The review looks at assistive technologies and the challenges faced by persons with visual impairments in accessing library resources and services in academic libraries. The following handful research have been conducted on this topic:

Manorama Tripathi & Archana Shukla (2014) focuses on the significance and use of assistive technologies in general, with particular emphasis on their application for visually impaired learners.

Rubina Anis (2015) illustrates how libraries and centres cater to the reading requirements of visually impaired through various assistive technology tools to facilitate their education and enhance the independence and autonomy of visually impaired students.

Raj Kumar Bhardwaj (2018) points out that the resources available to visually impaired students in higher education settings are quite rudimentary, making it challenging for them to study and conduct research with the current ICT infrastructure.

A. Smith and B. Johnson (2018) encounter numerous challenges in accessing library resources, including difficulties in navigating physical spaces and accessing printed materials by the visually impaired individuals. The authors emphasized the importance of implementing assistive technologies to improve accessibility for this user group.

Alabi & Mutula (2020) addresses the assistive technologies are helpful for people with disabilities. Library administrators need to focus on the budget, ensure proper technology locations, and appoint professional staff to support users with disabilities.

Aizan Sofia Amin... [et al.] (2021) showed that students with visual impairment experience five main challenges in higher education regarding financial, public stigma, accessibility, peer-to-peer acceptance and difficulties in learning at the university.

Dhananjay B. Sutar and Sujata Ashish Hande highlights on the assistive technologies to be essentially made available in libraries for extending the library facilities, information services and products in usable form to readers with visual impairment.

M. Ncubelt...[et al.] (2022) addresses the challenges faced by academic libraries in developing countries and aims to provide services to the patrons with visual impairment.

Rueda et al., (2022) explain the impact of ICT on students with visual impairment in higher education. They explained ICT tools, such as screen readers and magnifiers, are important for accessing digital information and learning materials.

Abhay Chaurasia and Ajay Pratap Singh (2022) briefs about the services provided by libraries to disable library users using software and hardware technologies. The paper emphasises specialised equipment, technologies, and services that provide a barrier-free environment to the disabled users in libraries and information centres, leading to many technological innovations and advancements for general and disabled persons.

4. OBJECTIVES OF THE STUDY

The primary goal of this study is to examine the assistive technologies implemented by academic libraries to support visually impaired individuals in India. This study will hold significant value for institutions serving this user group.

The objectives of the study are:

- To explore the different types of assistive technologies that academic libraries use to access library resources for visually impaired users.
- To identify the implementing challenges faced by the academic libraries.
- To identify the influence of assistive technologies on accessing library resources for individuals with visual impairments.
- To understand the training requirements for both visually impaired individuals and the professional staff responsible for managing library resources and services.

5. WHAT IS VISUAL IMPAIRMENT?

The term 'visual impairment' describes any non-correctable problem with vision or sight, which can range from complete absence of vision to conditions such as low vision, blurred vision, absence of side vision or not being able to see certain colours.

According to Howell and Lazarus, visual impairment is term used for people who have some degree of sight, but who have, for example, a limited range of sight or focus that cannot be easily corrected with spectacles who are squint, who need special learning to be able to see, who have burned vision somethings as a result of cataracts or who have tunnel vision.

According to Wikipedia "Visual or vision impairment (VI or VIP) is the partial or total inability of visual perception." (Retrieved from https://en.m.wikipedia.org/wiki/Visual_impairment)

According to the WHO, visual impairment is defined as a limitation of the visual system that can range from mild to severe.

The University of Oxford defined "Visual impairment (VI) as a term used to describe a loss of sight that cannot be corrected using lenses." (Visual impairment. University of Oxford. <https://edu.admin.ox.ac.uk/visual-impairment>)

6. WHAT IS ASSISTIVE TECHNOLOGY?

Assistive technology is an umbrella term that includes assistive, adaptive, and rehabilitative devices for people with disabilities and also includes the process used in selecting, locating, and using them. (Wikipedia)

According to the Assistive Technology Industry Association (ATIA), USA, Assistive technology (AT) is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of a person with disabilities.

American Library Association defines assistive technology as computer-based technology used to make it compatible with a specific type of person, such as persons with disabilities and enhance their potential. In simple words, assistive advances insinuate gadgets, items, etc., that are utilized to upgrade or improve the practical capacities in differently-abled people.

UNESCO (2006) defines assistive technology as a term that refers to the availability of assistive and adaptive devices to assist people with disabilities; equipment products that improve, enhance and maintain the functional abilities of persons with disabilities.

7. IMPORTANCE OF ASSISTIVE TECHNOLOGY

Assistive technology enhances autonomy by allowing individuals to carry out tasks they previously found challenging or were unable to complete, by offering improvements to alter the ways they interact with the technology necessary for those tasks. It empowers visually impaired individuals to participate fully in education, employment, and social activities. It helps them access information, communicate effectively, and navigate their environment independently.

8. INFORMATION ACCESS TO VISUALLY IMPAIRED PERSON

A visually impaired person has the same information needs as other sighted people. They also need access to information in an accessible format same as other people. Assistive technology has been specially designed to assist a person with disabilities in accomplishing their daily routine independently. Assistive technology allows people to be productive and independent as well as enable them to participate in education, which enhances their well-being and provides dignified lives. It can be said that assistive technologies are compensatory tools for people with disabilities.

9. ASSISTIVE TECHNOLOGIES FOR VISUALLY IMPAIRED PERSON

Academic institutional libraries provide services to the visually impaired person by using variety of software, tools and technologies. The following assistive technologies are used in different academic libraries to access library resources:

9.1 Software for Visual Impairment

- **Screen Reader Software:** Screen reading applications transform text displayed on a computer screen into either synthesized speech or braille output, enabling visually impaired users to access websites, documents, and other digital content. Popular available screen reader software: NVDA (Non-Visual Desktop Access), JAWS (Job Access with Speech), Windows Eyes, Open Book, Zoom Text, Kurzweil, Voice Over, Talk Back, BRELTTY, ORCA, Web Anywhere.
- **Screen Magnification Software:** This software magnifies or enlarge text or images on screen, making them more visible for those with low vision. Some screen magnification software: Zoom Text, Video Magnifier, MAGic, Built-in-features.
- **SAFA (Screen Access For All):** SAFA is an open-source software. This software supports various Indian languages like Hindi, English, Sanskrit, Marathi, etc. which helps visually impaired users to read and write in their own languages.
- **Text-to-Speech Software:** This software converts written text into speech, offering benefits like improved reading access, efficient content creation and assistance with learning and focus. Popular software: Supernova, Kurzweil, Claro Read, Read and Write Gold, Shruti Drishti (TTS).

- **Optical Character Recognition Software (OCR):** OCR technology allows to transform printed text into digital formats, facilitating access to printed materials for visually impaired individuals through electronic devices.
- **Voice Recognition Software:** These tools provide hands-free access to information, enabling individuals with visual impairments to interact with devices and utilize a broad range of services via voice commands. Popular voice recognition software: Dragon Naturally Speaking, Google Now, Voice Finger, Amazon's Alexa, Apple's SIRI, Via Talk.
- **Braille Translator:** Braille displays offer tactile feedback by converting digital text into braille characters, enabling visually impaired individuals to read and interact with electronic content. Braille Translators are: Braille 2000 / Duxbury Braille Translation Software (DBT), Libellous, SIXIN, Shruti Drishti (TTB).
- **Optical Braille Recognition Scanning Software (OBR):** This is a Microsoft Windows programming software that permits to read single and two-fold sided Braille records on a traditional flatbed scanner. It scans Braille records, analyse dot patterns and interprets them into standard text presented on a computer screen. Ideal for people who are not known to Braille.
- **Mobile Apps:** Numerous mobile applications have been specifically designed for people with visual impairments. These applications offer features such as text-to-speech, object recognition, navigation assistance and help with daily tasks. Few documents access related applications are: BARD Mobile, Voice Dream Reader, Speech Central, Google Lens.
- **Navigation Systems:** Navigation systems, which include GPS-based applications and wearable devices, deliver audio instructions and cues to aid individuals with visual impairments in independently moving through indoor and outdoor spaces. Few applications are: Voice Vista, Lazarillo, Good Maps Outdoors, Deep NAVI, Pathfinder.

9.2 Hardware for Visual Impairment

- **Refreshable Braille Displays:** This device connects to a computer or a smartphone to provide a tactile representation of digital text.
- **Braille Notetakers:** This portable braille device combines with a braille keyboard, allow users to take notes, access digital books and organise information.
- **Braille Embossers:** This converts electronic text into a hard copy brille document by embossing raised dots on a heavy paper.
- **Scanner:** It captures image of a printed document, which then converted into digital text to provide information via text-to-speech.
- **Specialized Keyboards**
 - 1) **Braille Keyboards Stickers:** In order to make keyboard labels tactually accessible stickers with Brailed characters can be used.
 - 2) **Power Chord Braille Keyboard:** A computer keyboard featuring six Braille keys and extra function keys.

- **Braille Writer:** A Braille Writer is a typewriter designed to create instant Braille text as you type.
- **Handheld Digital Magnifiers:** Portable devices that magnify images for reading and other tasks.
- **Handheld Digital Recorder:** A handheld digital recorder helps create self-notes, record lectures and dictate assignments.
- **Electronic Braille typewriters:** a tool that is a combination of Braille Writer and electronic note-taker. It produces an immediate hardcopy of Braille, allowing prior insertion and proofreading of text.
- **Low Vision Devices Kit:** It helps users to complete daily tasks more effectively and cheerfully. Optical and non-optical both devices are simple to use with proper training and guidance. Some low vision tools are
 - 1) **Spectacles:** Prismatic spectacles 10D, Aspheric Spectacles 20D
 - 2) **Lenses:** Fresnal book magnifier, Handheld magnifier, Pocket magnifier
 - 3) **Handheld Video Magnifier:** RUBY
- **Tactile Graphics:** Tactile graphics consist of raised, touchable representations of visual information that allow visually impaired individuals to feel and interpret diagrams, maps, and other graphical materials through touch.

These assistive technologies are essential in empowering people with visual impairments by improving their access to information, educational resources, job prospects, and social engagements. They promote increased independence and inclusion for those with visual impairments in multiple facets of their lives.

10. CHALLENGES IN IMPLEMENTING ASSISTIVE TECHNOLOGIES

Implementing assistive technologies in libraries to aid individuals with visual impairments can be a complicated task that presents various challenges. Some of the notable challenges include:

- **Awareness of Accessibility:** Insufficient awareness among library staff and administrators regarding the significance of accessibility and assistive technologies can impede their implementation. It is essential to promote awareness and offer training on accessibility principles and the use of assistive technologies.
- **Infrastructure and Funding:** Libraries must possess the required infrastructure, such as accessible workstations, devices, and software, to successfully implement assistive technologies. Limited funding and resource constraints can create obstacles in acquiring and sustaining these technologies.
- **Integration and Compatibility:** Ensuring that assistive technologies are compatible and integrated with existing library systems, databases, and digital platforms can be challenging. A seamless integration is crucial for providing users with a fluid experience and efficient access to library resources.

- **User Training and Support:** Sufficient user support and training are essential for individuals with visual impairments to effectively make use of assistive technologies. Libraries should establish training programs, provide documentation, and offer technical assistance to ensure users can fully benefit from these technologies.
- **Barriers in Library Resources:** Certain library resources, such as physical books, may create accessibility challenges for individuals with visual impairments. The implementation of assistive technologies should aim to eliminate these barriers by offering alternative formats, such as electronic texts or accessible e-books.

11. THE INFLUENCE OF ASSISTIVE TECHNOLOGIES ON ACCESSING LIBRARY RESOURCES FOR INDIVIDUALS WITH VISUAL IMPAIRMENTS

The role of assistive technologies in improving access to library resources for visually impaired individuals is an important area of investigation. This research seeks to explore and comprehend the specific impacts and advantages of assistive technologies in enhancing accessibility and information retrieval for visually impaired library users. It involves analysing the following elements:

- **Access to Digital Materials:** Evaluating how assistive technologies, such as screen readers and braille displays, empower visually impaired individuals to access and navigate digital library resources, including e-books, online databases, and digital archives.
- **Reading and Information Retrieval:** Examining how assistive technologies aid visually impaired individuals in reading and retrieving information from varied formats, such as printed materials, electronic texts, and multimedia content.
- **Search and Navigation Support:** Investigating the effectiveness of assistive technologies in aiding search and navigation within library catalogues, online databases, and digital interfaces, allowing visually impaired users to efficiently find relevant resources.
- **Text-to-Speech and Optical Character Recognition (OCR):** Analysing the effects of text-to-speech technologies and OCR in converting printed materials into accessible formats, thereby enabling visually impaired users to independently access printed resources.
- **Interactive and Multimodal Interfaces:** Assessing the advantages of interactive interfaces and multimodal technologies, such as touchscreens, haptic feedback, and audio cues, in enhancing engagement and interaction with library resources for visually impaired individuals.
- **Personalization and Customization:** Investigating the degree to which assistive technologies provide options for personalization and customization, such as adjustments in font size, colour contrast, and voice preferences, to accommodate individual needs and preferences.
- **Inclusive Learning and Collaboration:** Exploring how assistive technologies foster inclusive learning environments and collaborative experiences by allowing visually impaired individuals to engage in group activities, discussions, and information sharing within the library context.

By conducting thorough research on the effects of assistive technologies, this study aims to offer valuable insights into the concrete advantages and transformative impacts of these technologies on improving access to library resources for visually impaired individuals.

12. FOSTERING UNDERSTANDING AND TRAINING

Fostering understanding and offering training on assistive technologies for individuals with visual impairments in libraries is crucial for their effective use. This entails:

- **Educational Initiatives:** Implementing educational initiatives to inform library personnel, users, and the broader community about the existence and advantages of assistive technologies. These initiatives could encompass workshops, presentations, and informational materials that emphasize the significance of accessibility and the role of assistive technologies in improving access to library resources.
- **Personnel Development:** Delivering thorough training programs for library personnel on assistive technologies, accessibility standards, and best practices for assisting individuals with visual impairments. This training should include the operation and upkeep of specific assistive devices and software, as well as strategies for effectively supporting visually impaired patrons.
- **Patron Education:** Providing training sessions and personalized support to individuals with visual impairments on how to utilize the assistive technologies available in the library. These sessions should aim to aid users in navigating library resources, accessing digital content, using accessibility features, and adjusting settings to fit their specific requirements.
- **Collaboration and Partnerships:** Working together with disability organizations, assistive technology specialists, and accessibility advocates to deliver targeted training and support. These collaborations can infuse expertise, resources, and perspectives to strengthen awareness and training efforts.
- **Educational Materials:** Creating accessible guides, tutorials, and documentation that offer detailed instructions on the use of assistive technologies in the library. These materials should be available in accessible formats, such as large print, braille, or digitally accessible formats, to accommodate various needs.
- **Ongoing Education and Updates:** Keeping library staff and users informed about the newest developments in assistive technologies through regular updates, newsletters, or online platforms.
- **Accessibility Policies and Standards:** Formulating explicit accessibility policies and standards that detail the library's commitment to serving visually impaired individuals and promoting the use of assistive technologies.

By focusing on understanding and training, libraries can cultivate an inclusive atmosphere where staff and users are well-informed about assistive technologies, allowing visually impaired individuals to fully access and enjoy library resources and services.

13. CONCLUSION

People with visual impairments are often socially marginalized, facing challenges due to the disparity in the pace of information access advancements. Libraries have a moral responsibility to meet the information needs of all users, necessitating the acquisition of accessible technologies for those who require assistive devices to access library resources. The implementation of assistive technologies in libraries has significantly enhanced access to library resources for those with visual impaired. By utilizing tools like screen readers, braille displays, text-to-speech software, etc., visually impaired individuals can effectively navigate both digital and printed content, customize their reading experiences, and participate in collaborative learning environments. The research emphasizes the importance of raising awareness and providing comprehensive training on assistive technologies for both library staff and patrons. Collaborations with external organizations and the development of accessibility policies further support the effective integration of these technologies. The implementation of new technologies, such as artificial intelligence, virtual reality and wearable devices, to enhance the access of library resources for visually impaired library users. Through these initiatives, libraries can maintain their vital role in fostering an inclusive knowledge society where everyone, regardless of visual impairment, has equal access to information and resources.

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