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USE OF ASSISTIVE DEVICES AND ACCESSIBLE TECHNOLOGY FOR PERSONS WITH VISUAL IMPAIRMENT IN PUNJAB: AN EMERGING ISSUE

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ABSTRACT
This paper explores the impact of assistive devices and technology on the lifestyle of students with visual impairment and low vision in Patiala, Punjab. The study focuses on 50 respondents i.e. 30 with visual impairment and 20 with low vision who are attending senior secondary schools both from the special schools and school listed in inclusive education program. The findings revealed that voice assistant technology (50%) and digital talking book players (36%) are the most commonly used devices, while advanced tools like Braille displays (2%) and navigation apps (20%) have limited adoption. The study highlights the significant role of these devices in enhancing independence and access to education, moreover the study also examines the challenges posed by affordability and lack of training. The paper concludes that despite the benefits, gaps in access to more advanced technologies need to be addressed to fully empower this community.

Keywords: Assistive devices, visual impairment, low vision, inclusive education, technology, accessibility

INTRODUCTION
People who are visually impaired (VIPs) make up a large percentage of the population and are found all over the world. Modern technology has demonstrated its presence in every aspect of life, and inventive tools are helping people in every field. Artificial intelligence, in particular, has taken the lead and outpaced the other crafts. VIPs require support with activities of daily living, such as movement, navigation, and the detection and identification of objects and obstacles, both inside and outside of buildings. Furthermore, these people's safety and protection are of utmost importance. Numerous tools and software programs have been created to support VIPs. First off, these gadgets gather information from their surroundings using a variety of sensors, including infrared, ultrasonic, and imaging sensors. Modern machine learning approaches analyze these signals and extract valuable information in the second stage. Lastly, the user receives input via vibratory or audible means. It has been noted that the majority of current gadgets have limited functionality. Both partial and complete vision loss are included in the definition of "visual impairment." Near or distance vision impairment affects at least 2.2 billion people worldwide (W. H. Organization, 2022). Distance and near vision impairment are the two categories into which the International Classification of Diseases 11 (2018) divides vision impairment (d90 vision impairment including blindness, 1103).

The history of helping the blind and visually impaired is long and illustrious; in the past, people helped them walk.
Nonetheless, when assisting them, autonomous navigation is always given first priority. People with vision impairments have been using service animals since the middle of the 20th century. Mr. Humphrey trained the first service dogs for the blind and visually challenged in the United States, although the Germans started the concept during World War I (Guide dog, 2022).

The promotional white cane for the blind was accompanied by yet another amazing incident. From James Biggs to Richard E. Hoover, the white cane saw a rebirth to assist those who were blind or visually challenged during World War II (White cane, 2022). The braille used for reading was devised in 1824 by Louis Braille (Louis braille, 2022), but Mr. Seiichi Miyake developed the braille block for simple navigation in 1965 (Introduction for braille block, 2022). Driving became considerably easier for blind people thanks to this invention. Hoople was invented in 1990 when the white cane broke in the snow or sand (Hoople, 2022). Similar to Hoople, there have been numerous advancements in assistive technology, and as a result of technological progress, the wooden cane has evolved into a smart cane that is managed by a microprocessor. These days, there are many wearable technologies available, and the number of assistive gadgets has increased since 2000. A smart cane is a representation of the new generation of assistive technologies in this simple evolution illustration. By using solar panels to create environmentally friendly gadgets, scientists have made tremendous progress. Now, the gadgets can adjust to emergency situations, like the COVID-19 human tracing for people who are blind or visually impaired. The days seem to be getting better.

In today's world, a wide range of assistive devices and technology are available for children with visual impairment and low vision to enable access to the information and educational material. They are able to compete at par with other children and countless have excelled in their chosen fields. So, persons with visual impairment and low vision require the same opportunities, on an equal basis with others along with the specific supports and the reasonable accommodations that are extended to them under The RPwD Act, 2016. In the present paper an attempt has been made to explain the usage of available assistive devices and softwares for these persons to lead an independent life.

Following are some of the assistive devices and softwares which are used by the persons with blind and low vision:

Some of the assistive devices used by persons with visual impairment and low vision are:

Braille embosser

Similar to ink printers, braille embossers emboss braille characters onto paper for tactile reading by a blind reader. They can be for personal use at home, the office, or mass production.

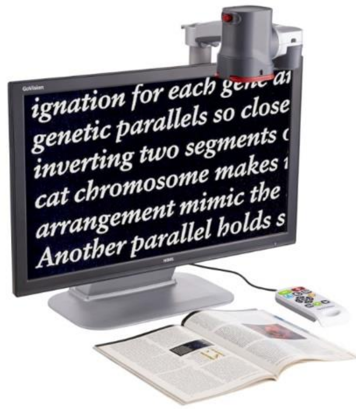
BRAILLE TYPEWRITER

Braille typewriter is a mechanical (hand operated) writing device used for writing Braille on paper by pressing related keys.

Daisy Player

DAISY stands for Digital Accessible Information System. It is a digital talking book format that offers many advantages over traditional audio books. This product is designed especially for people who are blind or have low vision include audio book players or DAISY players.

GoVision CCTV Magnifier and Reader



Look, Listen and Play!

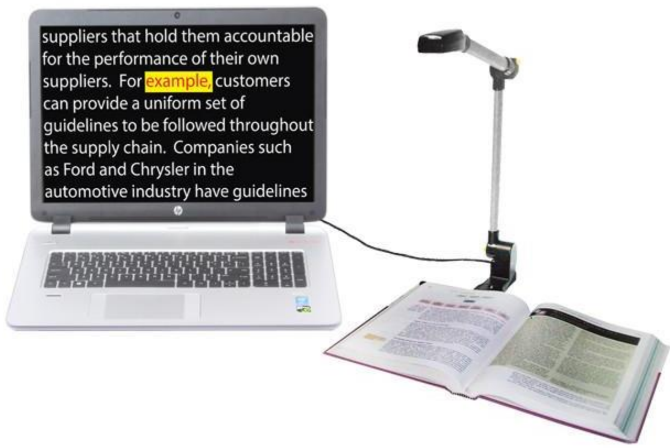
JAWS

JAWS, Job Access With Speech, is the world's most popular screen reader, developed for computer users whose vision loss prevents them from seeing screen content or navigating with a mouse. JAWS provides speech and Braille output for the most popular computer applications on your PC.You will be able to navigate the Internet, write a document, read an email and create presentations from your office, remote desktop, or from home.JAWS can read text and graphic information on a computer in almost any application, providing both speech and Braille output.

- Read documents. emails, websites and apps
- Scan and read all of your documents, including PDF

- Fill out webforms with ease
- Surf the net with web browsing keystrokes

PEARL FREDOM SCIENTIFIC SCANNER



The PEARL, combined with JAWS, Fusion, or OpenBook scanning and reading software, brings blind and low vision users instant portable access to printed material with an array of human-sounding voices. The folding camera deploys in seconds to connect to your PC and snap a picture of your reading material and begins reading it aloud instantly.

Portable Digital video Magnifier

Video magnifiers are one of many pieces of assistive technologies for blind or low-vision individuals.

A video magnifier, also called electronic/digital magnifier, is an electronic reading aid for people with severe visual impairment who cannot be helped using ordinary magnifying glass.

A digital magnifier is a device that magnifies text and images. It's essential for people who need to make things bigger if they can't see them well. For example, if your eyesight isn't good, these devices can help you read the newspaper or a book.

Braille display

A Braille display is a piece of hardware that turns text on a screen into Braille, generally connecting to a computer or cell phone via USB or Bluetooth. The display uses a system of raising and lowering pins in order to create Braille characters. As each braille character can have up to eight dots, every braille "cell" (a space for a single character) must contain eight small pins, and a motor or actuator to raise and lower each one. This means that Braille displays are large, expensive, and generally support displaying a limited number of characters at a time.

Smart cane

A smart cane is a device that detects impediments and uses voice to relay information to the sight impaired. Smart cane is a gadget that detects obstacles and this proposed method offers an innovative foldable smart cane that allows both visually impaired and deaf persons to navigate with sensors by detecting barriers automatically.

OBJECTIVES:

1. To assess the types of assistive devices and accessible technology
2. To evaluate the impact of assistive devices on academic performance and lifestyle impairments.
3. To analyze barriers to adoption
4. To explore the role of educational institutions
5. To identify potential improvements

RESEARCH METHODOLOGY:

1. Research Design:

This study follows a descriptive research design, focusing on a sample of students with visual impairment and low vision to understand their experiences with assistive devices.

2. Sampling:
A purposive sample of 50 students from senior secondary schools in Patiala is selected, including 30 students with visual impairment and 20 with low vision. The sample includes students from both special schools and those in the inclusive education program.

3. Data Collection:
Interviews: Semi-structured interviews are conducted with selected students to gain deeper insights into the challenges faced, their experiences with specific devices, and the support available in their schools.

4. Data Analysis:

- **Quantitative Analysis:** Data from the surveys is analyzed using descriptive statistics to determine the prevalence of device usage, impact on lifestyle, and common challenges.
- **Qualitative Analysis:** Responses from interviews are coded and analyzed thematically to capture the personal experiences and barriers faced by students with visual impairments.

FINDINGS:

i. Socio-Economic and Demographic Background of the Respondents:
The data regarding the socio-economic background of the respondents indicated that a maximum number of respondents i.e. 83 per cent belonged to the age group of 16-25 years, 64 per cent were males and 36 per cent were females,56.5 per cent of the respondents belonged to upper caste. The data regarding the background of the respondents indicated that 46 per cent had rural background and rest belonged to urban background.

ii. Use of Assistive Devices and Technology:
The most widely used tools are voice assistants and digital talking book players, which help students access information and navigate their studies more efficiently. Screen readers and Braille keyboards are also popular, though the use of more advanced tools such as navigation apps and Braille displays is minimal due to limitations in availability and training. Devices like smart glasses, Braille note-takers, and OCR tools are not available in Patiala due to affordability and the lack of specialized training.The findings show the distribution of students using different assistive devices:

S.No.	Content	Per Cent	Frequency
1.	Voice Assistant Technology (e.g., Google Assistant, Apple Siri)	50	25
2.	Digital Talking Book Players (e.g., Daisy Players)	36	18
3.	Screen Readers (e.g., JAWS, NVDA)	30	15
4.	Screen Magnifiers (e.g., ZoomText)	10	5
5.	Audio Book Services (e.g., SugamyaPustakalaya, Bookshare)	10	5
6.	Braille Keyboards	30	15
7.	Smart Cane	20	10
8.	Navigation Apps (e.g., Sugamya Bharat App, Be My Eyes)	20	10
9.	Braille Displays (e.g., Refreshable Braille Displays)	2	1

The data in Table 1 reveals the distribution of students with visual impairments and low vision using different types of assistive devices and technology. Voice assistant technology, such as Google Assistant and Apple Siri, is the most widely used (50%), followed by digital talking book players (36%) and screen readers like JAWS or NVDA (30%). While devices like screen magnifiers and Braille keyboards are also used, their adoption is lower, and more advanced tools like Braille displays (2%) and navigation apps (5%) have limited reach. However, some critical devices, such as smart glasses, Braille note-takers, OCR devices, and tactile graphics tools, remain unavailable in Patiala due to affordability and a lack of training. These limitations hinder access to essential technology that could significantly enhance the educational experience and independence of students with visual impairments.

iii. Benefits of Using Assistive Devices and Technology: Assistive technologies have made significant contributions to improving the lives of individuals with visual impairment and low vision. Some key benefits include:

- **Enhanced Independence:** Tools like voice assistants and smart canes enable students to navigate their environment independently, reducing their reliance on others.
- **Improved Access to Education:** Screen readers, digital talking book players, and Braille keyboards make academic materials more accessible, allowing students to participate more fully in classroom activities.
- **Increased Communication:** Devices like Braille displays and audio book services enhance communication skills, enabling students to engage more effectively with peers and teachers.
- **Time Efficiency:** Assistive technologies like screen magnifiers and OCR tools significantly reduce the time taken to read and process information, improving overall productivity.

S.No..	Content	Per Cent	Frequency
1.	Enhanced Independence	70	35
2.	Improves Access to Education	70	35
3.	Increased Communication	80	40
4.	Time Efficiency	30	15

iv. Challenges of Using Assistive Devices and Technology

Despite these benefits, there are several challenges that limit the widespread adoption and effectiveness of assistive technologies in Patiala:

- **Affordability:** Advanced devices such as smart glasses, Braille note-takers, and tactile graphics tools are expensive and out of reach for many students and institutions.
- **Lack of Training:** Even when devices are available, students and educators often lack the training to use them effectively, particularly with more complex tools like navigation apps and OCR devices.
- **Limited Availability:** Many essential assistive devices are not readily available in Patiala, restricting students' ability to access the full range of technological aids.
- **Technical Issues:** Some students report difficulty in troubleshooting and maintaining these devices, which can disrupt their learning and daily activities.

S.No..	Content	Per Cent	Frequency
1.	Affordability	60	30
2.	Lack of Training	70	35
3.	Limited Availability	70	35
4.	Technical Issues	66	33

Table 3 depicts the data of respondents facing challnges while using Assistive Devices and Technology

5. ANALYSIS

The findings indicate that while assistive devices and technology significantly enhance the quality of life for students with visual impairment and low vision, there is an uneven distribution of access and adoption. Voice assistants and digital talking book players are widely used because they are more affordable and easier to use, but more advanced devices remain largely inaccessible. The lack of training exacerbates these challenges, preventing students from fully utilizing the technologies that are available to them.

This uneven distribution has a direct impact on students' academic performance and daily independence. Students who can access and effectively use these technologies benefit from improved academic outcomes and greater confidence in navigating their environment. On the other hand, students who lack access or training are at a significant disadvantage, struggling to keep up with their peers and missing opportunities for personal development.

6. DISCUSSION

The results suggest that there is a need for targeted interventions to improve access to and training for assistive devicesand technology. . While simpler tools like voice assistants are making a substantial impact, the unavailability of more advanced technologies like Braille note-takers and OCR tools prevents students from fully realizing their potential. Financial subsidies and government initiatives could help bridge this gap by making these devices more affordable and accessible. Additionally, specialized training programs for both students and educators are critical for ensuring that these technologies are used to their fullest potential.

7. CONCLUSION

Assistive devices and technology have a profound impact on the lifestyle and educational opportunities of students with visual impairment and low vision. However, the uneven distribution of these tools, coupled with challenges related to affordability and training, limits their effectiveness. To create a more inclusive educational environment in Patiala, it is essential to address these gaps by improving access to advanced technologies and providing comprehensive training to students and educators. Only then can the full potential of assistive technologies be realized in empowering individuals with visual impairments and enhancing their quality of life.

There are many more assistive devices like talking calculators, thermometers, smar boards, interactive boards, colour teller machine and many items of daily use with the help of people with blindness and low vision can lead independent life. Most of these devices are the product of Western countries. High cost of these devices, non-availability, and lack of training to use these devices are some of the major hurdles in our country. Apart from these, lack of awareness, ignorance, negative attitude of society and family, and moreover, lack of implementation of legislations and policies at the grass root level are the main hinderances or impediments which obstruct transition of persons with blindness and low vision from dependency to an independent life.Thus, there is need to provide these devices at reasonable cost along the training.

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