विमर्श प्रवाह
Vimarsh Pravah
An Open Access, Bi-Annual, Blind Peer Reviewed, E-Research Journal
Vol. – II, Issue - II, Jan–June 2026
ISSN: 3049-0065 (Online)

Braille Readers' Perspectives on the Relevance of Braille in the Age of Artificial Intelligence

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Abstract:

The present study explores how people with visual impairment perceive the relevance of Braille in a world that is quickly becoming more digital. This study employed a descriptive study method, and data were collected from 150 visually impaired individuals across India. A three-point rating scale developed by researchers covering twenty items related to Braille awareness, usage, digital alternatives and its relevance, was administered to assess the perspective of people with visual impairment on the relevance of Braille in the age of Artificial Intelligence (AI). The findings of the study show that Braille remains very important for academic achievement, comprehensive reading and literacy development. While AI-based technologies such as mobile apps, audiobooks, smart glasses and online libraries are increasingly influencing reading practices. The COVID-19

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pandemic further accelerated this shift, as the fear of touching surfaces and a greater dependence on digital tools led to less Braille use. The study found that Braille is still widely used by people with visual impairment, especially for reading textbooks, taking notes, and learning language-related skills. Many participants also reported using mobile apps, screen readers, online libraries, and other digital tools in their daily lives because these technologies are easy to access and use. Differences were observed among participants of different age groups and backgrounds. Younger participants and those from urban areas appeared more comfortable with digital technologies, while older participants and experienced Braille readers continued to value Braille for learning and reading. The responses from the participants show that Braille and digital technologies are being used together by many people rather than one replacing the other.

Key Words: Braille, Artificial Intelligence, Visual Impairment, Inclusive Education.

Introduction

Braille has been used by people with visual impairment for reading and writing for almost two hundred years. It plays an important role in education and helps individuals read textbooks, write assignments, take examinations, and access information independently. Many studies have shown that Braille literacy is linked with better educational achievement, employment opportunities, and independent living among people with visual impairment (Ryles, 1996; Bell & Mino, 2015). Therefore, Braille continues to be regarded as an important tool for learning and full participation in society (World Blind Union, 2005).

The use of digital technology has increased among people with visual impairment. Many students with visual impairment now use screen readers, voice assistants, mobile apps, OCR tools, and online platforms to read information, communicate, and complete daily tasks. These technologies provide quick and convenient access to information (Kelly & Smith, 2011; Lazar, Goldstein, & Taylor, 2015). Because of these developments, some people question whether Braille

will remain important in the future. However, many educators and researchers continue to support the use of Braille because it helps learners develop reading, writing, spelling, and comprehension skills. Braille also supports independent learning and active participation in education (Jernigan, 1993; Schroeder, 1989).

Literature Review

Researchers reviewed the studies and organized these studies into three themes. These themes are Braille literacy, AI in accessibility and Braille readers' perspectives.

Braille Literacy- Braille continues to be used by many people with visual impairment for reading, writing, and learning. It helps students read textbooks, write notes, and study independently (Croake, Gentle, & Duncan, 2025). Stepien-Bernabe et al. (2019) reported that Braille users often perform better in reading comprehension tasks than those who depend mainly on audio formats. Braille also supports the development of spelling and writing skills (Egwim, 2023). Many users associate Braille with independence and confidence in daily life (Beudaert, 2024). At the same time, some studies have reported a decline in Braille use due to limited resources, lack of trained teachers, and increasing use of audio technologies (Kana & Hagos, 2024).

AI in Accessibility- Many people with visual impairment are now using AI-based technologies such as screen readers, voice assistants, and object recognition applications. These tools help them access information and completely different tasks more easily. However, Braille is still used by many people with visual impairment. According to the Assistive Technology Innovations Study (2025), Braille devices continue to be adopted by many people with visual impairment. Hoskin et al. (2024) suggested that further research is required to examine how AI-based tools can be used along with Braille in education.

Braille Readers' Perspectives- Many people with visual impairment use both Braille and digital tools according to their needs. Some of them prefer Braille for reading and studying, while others use screen readers and mobile applications for quick access to information (Jaleel & Anis, 2018).

Beudaert (2024) in his study found that Braille is still valued by many people with visual impairment because it supports reading and independent learning. At the same time, access to Braille materials and the cost of Braille devices continue to be difficulties for some persons with visual impairment.

Research Gap

Many studies have examined the use of assistive technologies for people with visual impairment. Most of these studies focus on the usefulness of digital tools such as screen readers, mobile applications, and AI-based technologies. However, fewer studies have explored what Braille users think about the changing role of Braille in their lives. In India, very little research is available on how Braille readers view the growing use of AI and digital technologies. The present study attempts to address this gap by examining the perspective of people with visual impairment from different backgrounds and regions of the country. Thus, the gap lies in understanding how Braille readers across diverse Indian contexts perceive the relevance of Braille in the age of AI, and how their demographic and contextual backgrounds influence these views. This study addresses that gap by placing Braille readers' voices at the centre of analysis. Therefore, this study is centred on the following questions:

1. What is the level of awareness of Braille among persons with visual impairment across various states of India?
2. How do Braille readers perceive the relevance of Braille in the AI era?
3. How do demographic and contextual factors (rural–urban background, experience, and age) influence these perspectives?

Objectives

1. To assess the level of awareness of Braille among persons with visual impairment across various states of India.
2. To explore Braille readers' perspectives on the relevance of Braille in the AI era.

3. To examine how demographic and contextual factors (rural–urban background, experience, and age) influence these perspectives.

Operational Definitions of the Key Terms

- Braille Awareness: Braille awareness is operationally defined as the participant's self-reported theoretical knowledge of Braille dot patterns. It is measured through responses to items assessing familiarity with the English Braille alphabet, Braille contractions, mother tongue Braille script, and Braille codes for basic mathematics and science notation.
- Braille Proficiency: In the context of present study Braille proficiency refers to the participant's self-reported practical ability to use Braille in real-life academic and daily tasks. It is measured through responses to items assessing the ease of reading Braille textbooks, writing class notes, labelling personal items, and taking notes during live lectures.
- Digital Divide: In this study, digital divide refers to the disparity in access to, usage of and preference for AI-based technologies between different demographic groups of visually impaired participants. It is measured through comparative analysis of responses across variables such as domicile (rural vs. urban), age (younger vs. older), and years of Braille experience. A wider gap between groups indicates a greater digital divide.
- Technological Adoption: In this study it is defined as the self-reported shift from Braille to AI-based tools for specific tasks. It is measured through responses to items assessing preference for AI tools over Braille and the reported decrease in Braille use due to external factors like the pandemic. Higher agreement indicates greater technological adoption. Higher levels of agreement correlate with a greater rate of technological adoption.

Methods

Research Design: This study adopted a quantitative, cross-sectional approach to examine Braille literacy levels and explore how readers perceive Braille's relevance in an AI world.

Population, Sample and Sampling: The population of the study included Braille readers with visual impairment across India. A total of 150 participants were selected. Sample representation from different states, age groups, educational backgrounds, rural–urban settings, and levels of Braille experience. Participants were selected from ten states of India using purposive and snowball sampling techniques.

Data Collection Instrument: Data was collected using a self-made questionnaire. The questionnaire consisted of two sections:

Section A: This section gathered key demographic data, including participants' age, geographical location, and years of Braille experience.

Section B: This section consisted of 20 items that used a three-point Likert scale with the response choices of Agree, Neutral, and Disagree. Section B was divided into two parts, i.e.

> Part B1 of the instrument, which included 10 questions, was designed to assess participants' Braille proficiency, such as their knowledge of scripts and their use of Braille in daily reading and writing
>
> Part B2 of the instrument, with its 10 items, measured opinions on how relevant Braille remains in an era of AI and digital technology.

The items were developed based on a review of related literature and expert consultation to ensure content validity. A pilot test was conducted with a small group of participants, and necessary modifications were made to improve clarity and reliability.

Data Collection Procedure

The questionnaire was administered both in accessible digital formats (Google Forms, screen-reader compatible) and in Braille/printed formats where required. Participants were contacted

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through social media platforms and through institutions for the visually impaired, NGOs and special schools. Informed consent was obtained, and participation was voluntary.

Result

A total of 150 persons with visual impairment from 10 states (Uttar Pradesh-71, Madhya Pradesh-13, Uttarakhand-12, Delhi-11, Haryana-10, Bihar-09, Rajasthan-08, Maharashtra-06, Chhattisgarh-05 and Rajasthan-05 participants) participated in this study. State-wise list of the participants is given in Table 1.

Table 1: Demographic Profile of Participants (N = 150)

Category	Details	Frequency (n)	Percentage (%)
State	Uttar Pradesh (highest)	71	47.3%
	Other States (9 combined)	79	52.7%
Gender	Male	125	83.3%
	Female	25	16.7%
Domicile	Rural	98	65.3%
	Urban	52	34.7%
Educational Status	Studying	126	84.0%
	Education Completed	24	16.0%
Programme Enrolled	Special Education	45	30.0%
	Under Graduation	45	30.0%
	Sr. Secondary	10	6.7%
	Others	16	10.7%
Age Range	18–30 years (Average range)	—	—

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The study included 150 participants from ten states of India, with the largest share from Uttar Pradesh (47.3%). Most of the participants were male (83.3%), rural (65.3%), and within the 18-30 years age range. This reflects a young demographic. Most participants were students (84.0%), mainly enrolled in Special Education Teacher Training Programme (30.0%) and undergraduate programmes (30.0%). Table 1 shows that participant profile heavily weighted toward young, rural learners and teacher trainees. Consequently, their viewpoints reflect a dual experience i.e. foundation in traditional Braille combined with growing exposure to AI-based tools.

Table 2 presents a comprehensive overview of the level of Braille awareness and usage among people with visual impairment. The data was collected through awareness tools.

Table 2: Braille Awareness and Proficiency Among Participants (N=150)

Thematic Category	Statements	Response (%)		
		Agree	Neutral	Disagree
Braille Awareness (Knowledge)	I am familiar with the dot patterns of the English Braille Grade I.	90%	8%	2%
	I can identify the dot patterns of Braille contractions (e.g., “ch”, “ing”, “th”).	70%	17%	13%
	I know the Braille script for my mother tongue.	85%	10%	5%

	I am familiar with the Braille codes for basic mathematics (e.g., numbers, symbols like +, -, =)	60%	30%	10%
	I recognise the Braille codes used for basic science notation (e.g., chemical symbols, metric units).	25%	30%	45%
Braille Proficiency (Practical Usage)	I can read an English Braille textbook fluently.	83%	10%	7%
	I can read my mother tongue Braille textbooks	85%,	5%	10%
	I find it easy to write my class notes independently using a Braille slate & stylus	68%	20%	12%
	I regularly use Braille to label my personal items (e.g., medicines, files).	42%	13%	55%
	I can efficiently take down notes in Braille during a live lecture or meeting.	74%	8%	18%

Table 2 shows that most participants were familiar with English Braille and Braille in their mother tongue. Between 85% and 90% of the respondents reported knowledge of these Braille systems. Many participants were also comfortable reading Braille textbooks and taking notes during lectures. However, knowledge of mathematics and science Braille codes was comparatively lower. Knowledge of mathematics and science Braille codes was lower than general Braille literacy. About 60% of the participants were familiar with mathematics codes, while 25% knew science notation. Many participants used Braille for reading and study-related activities. However,

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more than half of the participants did not use Braille for labelling personal items. This pattern shows differences in the use of Braille for educational purpose and daily living activities.

Table 3: Braille Awareness and Proficiency Among Participants (State-wise)

State	Participants (n)	Know English Braille Grade-I (%)	Know Mother Tongue Braille (%)	Use Braille for Taking Notes in the Classroom (%)
Uttar Pradesh	71	92%	88%	75%
Madhya Pradesh	13	91%	83%	70%
Uttarakhand	12	95%	85%	82%
Delhi	11	90%	80%	60%
Haryana	10	88%	90%	83%
Other States (Combined)	33	89%	82%	71%

Table 3 shows that knowledge of English Braille and mother-tongue Braille was high in all the states included in the study. More than 88% of the participants from all the selected states were familiarity with English Braille and mother-tongue Braille. The use of Braille for taking notes was highest in Haryana (83%) and Uttarakhand (82%). Uttar Pradesh reported 75%, while Delhi reported 60%. These percentages show that Braille is used for note-taking and other educational activities across different states, although the level of use is not the same everywhere.

Table 4: Summary of Braille Readers' Perspectives in the AI Era (N=150)

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Thematic Category	Statement	Agree	Neutral	Disagree
Value of Braille	Reading a Braille book is better than listening to an audiobook.	71%	5%	24%
	I can complete academic work easily without knowing Braille.	33%	12%	55%
Role of AI & Technology	I prefer to record lectures instead of writing them in Braille.	55%	7%	38%
	I prefer using AI-based technology and mobile apps over Braille.	57%	11%	32%
Threat Perception	I believe Braille is unnecessary since AI-based technology is available.	30%	9%	61%
	With new AI-based technologies, Braille will not be needed in the next few years.	42%	10%	48%
External Impact (COVID-19)	The COVID-19 pandemic made me afraid to touch Braille books.	63%	9%	28%
	My interest in reading Braille has lessened since the pandemic.	59%	11%	30%
Education Policy	The availability of online libraries has decreased demand for Braille books.	66%	10%	24%
	We should prioritise teaching AI and mobile apps over Braille.	39%	11%	50%

Table 4 shows that many people with visual impairment continue to value Braille for reading and academic work. 71% of the participants preferred Braille books, while 55% did not agree that Braille could be replaced in academic work. Many respondents also reported using recorded

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lectures and AI-based applications. About 61% disagreed with the statement that Braille is no longer necessary. Several participants reported greater use of digital resources after the COVID-19 pandemic. The table shows that participants use both Braille and digital technologies for different purposes.

Table 5: Perspective on Braille's Relevance (State-wise)

State	Participants (n)	Prefers Digital Tools for Efficiency (%)	Values Braille for comprehensive Reading (%)	Believes Braille is Unnecessary due to AI (%)	Pandemic Reduced Braille Use (%)
Uttar Pradesh	71	58%	68%	28%	65%
Madhya Pradesh	13	62%	75%	33%	58%
Uttarakhand	12	71%	70%	35%	60%
Delhi	11	75%	60%	45%	60%
Haryana	10	67%	50%	37%	73%
Other States (Combined)	33	54%	73%	31%	62%

As per Table 5, participants from Madhya Pradesh (75%) and Other States (73%) were generally using Braille for reading activities. In Delhi, 45% of the participants felt that Braille may become less important in the future, whereas the percentage was lower in Uttar Pradesh (28%). Participants from Haryana reported highest percentage (73%) who stated that their Braille use decreased during the COVID-19 period. The table shows some differences among the states in the responses given by the participants.

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Table 6: Urban vs. Rural Perspective

Domicile	Participants (n)	Prefers AI/Apps (%)	Believes Braille is Fundamental (%)	Pandemic Fear (%)
Urban	45	65%	52%	58%
Rural	105	54%	60%	65%

Table 6 shows that 65% of the urban participants used AI-based applications, while 60% of the rural participants reported the importance of Braille for literacy. During the COVID-19 period, 65% of rural participants reported reduced use of Braille compared to urban respondents (58%). The responses from both groups show the use of Braille and digital technologies, although some differences are visible in the reported percentages.

Table 7: Perspective by Braille Experience

Experience	Participants (n)	Agree: "Braille will not be needed in future"
< 2 years	15	60%
2-10 years	50	48%
10-20 years	60	38%
20+ years	25	32%

Table 7 shows differences in opinion according to years of Braille experience. 60% of the participants with less than two years of Braille experience felt that Braille may not be needed in the future. Among participants with more than 20 years of Braille experience, the percentage was 32%.

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Table 8: Perspective by Age Group

Age Group	Participants (n)	Prefers Digital Tools (%)	Pandemic Reduced Interest (%)
≤ 20 years	35	64%	68%
21-30 years	95	56%	58%
31+ years	20	45%	50%

Table 8 shows that 64% of the participants aged 20 years or below used digital tools. In this group, 68% reported reduced use of Braille during the COVID-19 period. Among participants aged 31 years and above, 45% used digital tools and 50% reported reduced Braille use. The responses are mixed across age groups, although participants from all groups reported using both Braille and digital technologies.

Major Findings of the Study and Discussion

The study was conducted to understand the views of Braille readers regarding the use of Braille in a period when AI-based technologies are becoming more common. The responses collected from the participants show that Braille continues to be used for reading, writing, studying, and other educational activities. Most of the participants reported good knowledge of English Braille and mother-tongue Braille. Braille was commonly used for reading textbooks and taking notes. Similar findings have been reported by Ryles (1996) and Koenig and Holbrook (2000), who highlighted the importance of Braille for literacy among people with visual impairment.

The study also found lower familiarity with mathematics and science Braille codes. The use of Braille for activities such as labelling personal belongings was reported by fewer participants. This shows that Braille is used more often for educational work than for some daily activities.

Many participants reported using mobile applications, recorded lectures, screen readers, and other digital tools along with Braille. Wiazowski (2014) in his study also found that people with visual impairment often use a combination of Braille and technology. Most participants did not agree that Braille is no longer needed, although some felt that its use may decrease in the future. The responses also mixed across age groups, place of residence, and years of Braille experience. Younger participants and urban respondents reported greater use of digital technologies, whereas older and experienced Braille users reported greater use of Braille. Similar patterns have been reported by Lissner (2007) and Kamei-Hannan and Ricci (2015).

Overall, the responses suggest that Braille continues to be important for literacy and education. At the same time, AI-based technologies are becoming a regular part of everyday life. Rather than replacing Braille, these technologies appear to be used alongside it to support learning and access to information.

Recommendations

The responses collected in this study suggest that Braille instruction should continue to receive attention in educational and rehabilitation programmes. Greater emphasis may be given to areas such as mathematics, science, and the use of Braille in daily life activities. Participants also reported regular use of digital tools; therefore, Braille and assistive technologies can be taught together so that learners are able to benefit from both. Efforts are also needed to improve access to assistive technologies in rural areas where resources may be limited. Training programmes may be planned according to the needs of different age groups and levels of experience. Such measures can help people with visual impairment make effective use of both Braille and emerging technologies in education and everyday life.

Conclusion

This study examined the views of people with visual impairment regarding the role of Braille in a time when AI-based technologies are becoming more common. The study included 150 participants with visual impairment from different states of India. The responses show that Braille continues to be mainly used for reading, writing, and educational activities. Many participants reported using Braille for reading textbooks and taking notes. At the same time, they also used screen readers, mobile applications, online libraries, and other digital tools in their daily lives. The use of digital technologies was reported more frequently by younger and urban participants, while many older and experienced Braille users continued to rely on Braille. The COVID-19 period also increased the use of digital resources among several participants. The study shows that Braille and digital technologies are both being used by people with visual impairment. Braille remains useful for literacy and learning, while digital tools provide additional support for accessing information.

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