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Harnessing Artificial Intelligence and Blended Learning for Visually Impaired Students: Pathways to Digital Inclusion

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Abstract

Keywords:

Artificial intelligence;
assistive technology;
blended learning;
digital inclusion;
visual impairment.

Blended learning combined with Artificial Intelligence (AI) has revolutionized inclusive education and made it more accessible for visual impairment (VI) students. However, the implementation of digital tools in mainstream schools of India remains constrained by digital infrastructure, the lack of preparedness of teachers and policy-practice gaps. This mixed methods study analyzes the effect of blended learning (BL) using AI on access, engagement, and inclusion of students with VI in the Delhi – NCR schools. A total of 50 students with visual impairments and 10 teachers and 10 parents were participated in the quantitative data collection, and qualitative data collection was done with 10 teachers and 10 parents. The findings showed that 68% of pupils felt that AI-powered assistive tools would be helpful when learning at their own speed, while just 32% said that their teachers were well-trained to use accessible digital platforms when learning. AI powered blended learning positively increases learner autonomy, engagement and digital inclusion when embedded in inclusive teaching pedagogies and teacher professional development. The study suggests that enhancing teacher training, implementing Universal Design for Learning (UDL), and making sure that AI-powered assistive technology is accessible to all students can help create inclusive and accessible learning environments.

Abstrak:

Kata Kunci:

Inklusi digital;
kecerdasan buatan;
pembelajaran bauran;
teknologi asistif;
tunanetra

Pembelajaran *blended* yang dipadukan dengan kecerdasan buatan (AI) telah membuka peluang baru dalam penyelenggaraan pendidikan inklusif, termasuk bagi siswa dengan tunanetra. Namun, penerapan teknologi digital di sekolah umum di India masih menghadapi sejumlah kendala, terutama keterbatasan infrastruktur digital, kesiapan guru yang belum memadai, serta kesenjangan antara kebijakan dan praktik di lapangan. Penelitian dengan metode campuran ini bertujuan menganalisis pengaruh pembelajaran blended berbasis AI terhadap akses, keterlibatan, dan inklusi siswa dengan tunanetra di sekolah-sekolah di Delhi NCR. Pengumpulan data kuantitatif melibatkan 50 siswa dengan tunanetra, 10 guru, dan 10 orang tua, sedangkan data kualitatif diperoleh dari 10 guru dan 10 orang tua. Hasil penelitian menunjukkan bahwa 68% siswa menilai teknologi asistif berbasis AI dapat membantu mereka belajar sesuai dengan kecepatan masing-masing. Namun, hanya 32% siswa yang menyatakan bahwa guru mereka telah memperoleh pelatihan yang memadai untuk menggunakan platform digital yang aksesibel dalam pembelajaran. Pembelajaran blended berbasis AI dapat meningkatkan kemandirian belajar, keterlibatan, dan inklusi digital siswa apabila diterapkan

dalam pembelajaran inklusif yang didukung oleh pengembangan kompetensi profesional guru. Oleh karena itu, penelitian ini merekomendasikan penguatan pelatihan guru, penerapan *Universal Design for Learning* (UDL), serta penyediaan teknologi asistif berbasis AI yang dapat diakses oleh seluruh siswa guna menciptakan lingkungan pembelajaran yang lebih inklusif dan setara.

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Introduction

The fast digitalization of the education sector of the last ten years has changed the classical teaching methodology to the hybrid technology-mediated learning environments. This change, accelerated by international reform initiatives and domestic efforts including the National Education Policy (NEP) 2020 in India and the Digital India Mission, puts an emphasis on flexibility, personalisation and accessible inclusion with the help of blended learning models and artificial intelligence (AI) based learning solutions. NEP 2020 specifically highlights the importance of digital technology, open educational resources (OER), and assistive technologies in reducing the educational inequality and enhancing equity among learners of various groups.

For learners with visual impairment (VI), these technological advances are offering groundbreaking opportunities for inclusive participation. Artificial intelligence-powered tools, including screen readers (e.g., NVDA, JAWS) and text-to-speech systems, object-recognition engines, OCR (optical character recognition) or real-time audio description, are currently all finding their way into the education sector. These assistive technologies allow VI students to read and comprehend textual data, perceive graphical information and interact in digital learning activities, as well as work independently.

However, the promised policy and the potentials of technology have not always transferred to the ground in terms of inclusion. Many Inclusive schools in India continue to struggle with inaccessible e-learning platforms, inadequate teacher training in inclusive pedagogy, and high costs or unavailability of assistive devices. The digital inclusion gap—particularly affecting students with disabilities—remains wide. UNESCO (2023) and UNICEF (2024) highlight that achieving meaningful inclusion depends not just on access to technology, but on how it is embedded in pedagogy, supported by institutional structures, and sustained by human capacities. In India, blended learning is now positioned as a resilient, post-pandemic model—combining the strengths of face-to-face interaction with the affordances of digital instruction. However, for VI learners, the success of blended models depends critically on (a) the accessibility of materials (e.g., screen-readable formats, audio descriptions, tactile alternatives), (b) the teacher's competence to integrate AI/assistive tools meaningfully, and (c) the availability and affordability of adaptive technologies.

This study investigates how AI integrated blended learning environments influence the educational experiences of students with visual impairments in mainstream schools in Delhi NCR. It examines how AI driven learning can enhance personalized learning, accessibility, academic engagement, confidence, independence, and social participation while addressing challenges related to digital access, assistive technology, and teacher preparedness. From a guidance and counseling perspective, the study aims to provide evidence to support inclusive educational practices, counseling services, and policy development that promote equitable participation and holistic development. The study also aligns with the inclusive education goals of NEP 2020 and NCF 2023 by supporting digitally accessible learning environments that enable students with visual impairments to participate meaningfully and maximize their educational potential.

Over the past decade, educational delivery has undergone a major transformation through the integration of digital technologies and blended learning approaches. Globally, UNESCO (2023) highlights that Artificial Intelligence (AI) and digital tools are reshaping inclusive education by enhancing accessibility, adaptability, and personalization. For learners with disabilities—especially those with visual impairment (VI)—AI-driven assistive technologies such as JAWS, NVDA, Seeing AI, and other OCR and voice-based navigation systems have created new opportunities for independent learning and equitable participation (World Health Organization, 2022). Nevertheless, in spite of these developments, some studies warn that the AI-assisted inclusion potential is also constrained by the insufficient teacher readiness and institutional backing. As Nguyen and Wilkins (2020) noted, despite the ability of AI-based tools to enhance the access of VI students, their usefulness was limited by the digital illiteracy and insufficient awareness of accessibility design by teachers. Similarly, Zaveri and Sharma (2023) discovered that the majority of Indian EdTech tools were not in line with the international accessibility standards, including the WCAG 2.1, limiting their usability by visually impaired students. The studies in Indian schools (Bhardwaj, 2021; Mehra and Sharma, 2023) also indicate that despite the increase in the digital infrastructure, the lack of adaptation of learning resources and inadequate capacity-building of teachers leads to partial and unequal inclusion.

The National Education Policy (NEP) 2020 was an important move in the Indian context towards inclusive and technology-enabled education. It focuses on combining the Information and Communication Technology (ICT) and assistive technologies (AT) to meet the needs of learners with disabilities and facilitate equitable and inclusive education to everyone. Besides NEP 2020, there are Digital India Mission and Samagra Shiksha Abhiyan, which include PM eVIDYA, DIKSHA and SWAYAM, which has the intention of creating accessible e-learning environments. The name of the Accessible India Campaign (Sugamya Bharat Abhiyan) only supports the necessity of an access to physical and digital infrastructure without any barriers. However, despite these models, research and real-life experiences (UNICEF, 2024; NCERT, 2023) demonstrate that most schools do not offer teacher training, access to available online resources, and a low-cost assistive technology to establish a meaningful inclusion.

One of the best-known ideas, which integrates online and face-to-face learning, is the idea of blended learning that has proven to be flexible and capable of accommodating a variety of learners. This practice has now been the focus of educational reform after the pandemic (OECD, 2023). Research like that by Magdalene et al. (2022) and Bhardwaj (2021) indicates that with the compatibility of the digital elements with the assistive technologies, blended learning can be used to improve participation and engagement among visually impaired students. Pacing and self-directed learning are possible since the interaction between the physical and digital content is combined with AI. However, Hameed, Kumar, and Jindal (2020) found that teachers often rely on visually centred teaching materials such as PowerPoints and infographics, which exclude students with VI unless properly adapted.

Teacher preparedness and digital literacy are recurring concerns across literature. Mehra and Sharma (2023) highlight that most Indian teachers lack structured training in AI-assisted inclusive pedagogy. Their study revealed that even in technology-equipped schools, educators were unaware of accessibility features within standard learning platforms. This aligns with UNESCO's Global Education Monitoring Report (2023), which stresses that teacher digital competence and the integration of inclusive design principles are prerequisites for equitable digital transformation. Yadav and Mehra (2022) also note that without regular capacity-building, teachers' dependence on inaccessible EdTech content perpetuates digital exclusion for learners with disabilities.

Policy documents from the Ministry of Education (2023–24) emphasize the need for digital inclusion through initiatives like NISHTHA 2.0 (teacher training), Indian Sign Language Dictionary, and the development of accessible e-content for students with disabilities on platforms such as DIKSHA. These efforts are, however, inequitably enforced. UNICEF (2024) notes that in low-resource settings, affordable internet access and learning devices are unavailable, which means that

visually impaired students cannot effectively use the internet or AI-based learning. Equally, Guddad (2025) determines that digital exclusion is one of the greatest issues in low- and middle-income countries where inclusive EdTech ecosystems continue to develop. These efforts are, however, inequitably enforced. According to UNICEF (2024), in low-resource environments, there is no access to affordable internet, or even learning devices, thus visually impaired students cannot utilize the internet and AI-based learning properly. Equally, Guddad (2025) determines that digital exclusion is one of the greatest issues in low- and middle-income countries where inclusive EdTech ecosystems continue to develop.

Irrespective of these obstacles, the international and Indian researches come to the same conclusion, that AI-based blended learning is potentially transformative. As long as the provided content, teacher training, and sound policy support it, it enhances teacher autonomy, teacher engagement, and learning performance in students with VI (Rohleder, 2018; UNESCO, 2023). However, little empirical studies have specifically targeted the role of the AI applications in blended learning settings in the Indian inclusive schools, the mediating role of teachers in the context of such applications and the effects of these applications on the academic experiences of the visually impaired students.

Thus, the current literature indicates a strong urgency to shift the focus off policy rhetoric and delve into the reality of the practicalities of implementing AI and blended learning to the students with visual impairment in India. This gap is filled in the current research paper by discussing the impediments to accessibility, teacher readiness, and student engagement in AI-based blended learning and thus adds to the increasingly popular discussion of digital inclusion and fair education within the context of NEP 2020 in India.

The present study offers a novel perspective by integrating the strengths of Artificial Intelligence (AI) and blended learning to expand educational opportunities for students with visual impairments. It examines the synergy between AI driven tools and blended learning strategies to explore their potential to enhance accessibility, engagement, and academic participation. Unlike previous studies that have primarily examined assistive technologies or online learning separately, this study investigates how these tools and strategies can be integrated to address the educational challenges experienced by students with visual impairments in contemporary learning environments. The study further provides a context specific perspective on digital inclusion by highlighting the opportunities, challenges, and implementation requirements associated with creating more inclusive learning environments. Its findings have implications for educational practitioners, policymakers, and educational institutions seeking to develop equitable and technology enabled learning environments for students with visual impairments.

Digital and AI enabled technologies are rapidly transforming education worldwide, yet their potential to support students with visual impairments in India remains underrealized. Although initiatives such as the National Education Policy (NEP) 2020 and Digital India promote educational technology, classroom implementation remains uneven, with limited attention to the experiences of visually impaired learners in AI assisted blended learning. This study addresses this gap by examining how AI enhanced blended learning can improve participation, autonomy, and learning outcomes while considering access, digital readiness, and psychosocial adjustment. The findings are expected to inform policy implementation, teacher education, and accessible digital ecosystems aligned with Universal Design for Learning (UDL) and the inclusive vision of NEP 2020, ultimately supporting greater equity and empowerment for students with visual impairments.

There are four objectives in the study. The first objective is to assess the usability of AI-based assistive technologies and blended learning platforms by students with visual impairment. The second objective is to investigate teacher preparedness, computer literacy and teaching adjustment in inclusive classrooms with AI. The third objective is to identify the interaction of VI students in blended learning classes. The fourth objective is to find the infrastructural obstacles that influence the digital inclusion of the visually impaired learners in the inclusive schools.

Method

In the present study, the research design was mixed methods research, which aimed to explore the accessibility, inclusion, and effectiveness of the blended learning environment with the inclusion of artificial intelligence (AI) for students with visual impairment (VI) in inclusive schools. To get a complete picture of a phenomenon by combining both quantitative and qualitative data, the mixed methods approach was chosen. The quantitative part allowed the researcher to explore patterns and trends in terms of accessibility, teacher preparedness, learner engagement and inclusive practices, while the qualitative part enabled the researcher to explore in-depth the lived experiences and perspectives of various stakeholders within the context of AI enabled blended learning. The combination of both approaches provided methodological triangulation and greater credibility and richness of the findings.

Research Procedure

The study was carried out in inclusive government schools and private schools in the Delhi – NCR region. The school authorities were first approached for permission and informed consent was obtained from all participants. To gain a quantitative understanding of the experiences of students with visual impairment in AI-integrated blended classrooms, a structured questionnaire was used. Following this, interviews with parents and special education teachers were carried out using a semi-structured format to obtain more in-depth information about issues relating to access, teacher preparedness, student engagement, and support provided to students with visual impairment. Classroom observation, field notes, and online learning sessions were also conducted, and contextual factors in implementing the AI-supported blended learning practices were documented. The survey data, interview data and observation data gathered were then summarised, sorted and analysed systematically to answer the research questions of the study. The participants were briefed before data collection about the purpose and the goals of the study. They were all volunteers and informed consent was obtained. The participants' confidentiality and anonymity were protected throughout the study. All the information obtained was for research and academic use only.

A total of 70 respondent chosen for data collection. The quantitative sample comprised of 50 students with visual impairment ($N=50$) in Classes VI to XII of government and private schools of inclusive education. These students were from different educational backgrounds and educational experiences with AI-supported blended learning environments. In the qualitative phase of the study, there were ten special education teachers ($N = 10$) who caters the needs of students with visual impairment. They were able to share insights gained from their experiences, which covered areas such as instructional practices, technological readiness, accessibility issues, and the difficulties of implementing AI-integrated learning.

Parents of students with visual impairment ($N = 10$) were interviewed to learn about the learning experiences at home, accessibility problems, parental support, and perceptions of the effectiveness of AI-based blended learning. Respondents were selected using purposive sampling, which aimed to have the participants come with direct experiences and relevant knowledge of AI-integrated blended learning environments, platforms and devices.

Data Collection Methods

Various data collection techniques were used, as it is necessary to obtain all the facts related to the problem of the research. Students with visual impairment were administered with structured questionnaire, which aims to evaluate students' experiences on accessibility, inclusion, teacher support, engagement, and effectiveness of AI-supported blended learning environment. Special education teachers and parents were interviewed using semi-structured interviews. The interviews resulted in detailed information on opportunities and challenges related to AI-supported learning, accessibility measures, preparedness of teachers, parental awareness & accessibility related to AI

platforms and its uses which provided the overall educational experiences of students with visual impairment with in the school and in their homes. Field notes were also taken whenever feel necessary for detailed information and documented with observations. Observations of in-class and online learning sessions were conducted to grasp the implementation of AI-integrated blended learning. Students' involvement, interaction, accessibility, instructional approaches, and contextual elements that shaped learning experiences were captured in field notes. This, Multiple data collection techniques helped to establish triangulation and increased the credibility of the results.

Research Tools and Validation Process

The method used for collecting the data quantitatively was structured questionnaire, which was applied to students with visual impairment. The survey was structured into five sections: (i) availability of AI-integrated learning platforms, (ii) accessibility and use of assistive technologies and AI-driven learning platforms, (iii) teacher readiness and instructional support, (iv) learner engagement and participation, and (v) effectiveness of blended learning environments. A 3-point Likert scale was used to measure 20 items in each domain. There were 20 items in each domain measured on a 3-point Likert scale: Always (3), Sometimes (2), and Never (1). Semi-structured interview schedules were designed for each group (Parents, Special Education Teachers) for the qualitative data collection. The six general questions covered in the interview schedules were related to digital accessibility, support of learning with the use of AI, preparedness and competencies of teachers, participation and engagement of learners, support and obstacles in the setup, and suggestions for improving the application of AI-assisted blended learning for learners with visual impairment. After a thorough literature study, the research instruments were developed and then validated by experts on inclusive education, educational technology and special education to determine the content validity and relevance.

Validity Process

Content validity of the questionnaire and interview schedules were checked by a panel of experts in Inclusive Education, Special Education, Educational Technology and Research Methodology. The suggestions for clarity and relevance, language appropriateness and congruence with the study objectives were integrated into the final versions of the instruments. A pilot study with a limited number of participants representing the target population was done to uncover ambiguities and enhance the usability of the instruments. The pilot feedback was used to make the necessary changes prior to the final administration.

Data Analysis

The quantitative data collected from the questionnaire were coded and analysed using descriptive statistical techniques. Patterns of accessibility, teacher preparedness, learner engagement, and inclusion in AI-integrated blended learning environments were explored using frequencies, percentages, means and standard deviations. Thematic analysis was used to analyse the qualitative data derived from the interviews and field notes. The interview transcripts and observation sheets were thoroughly analysed, coded and sorted into themes. These were then categorized as larger groups of codes that reflect major concerns that included accessibility barriers, teacher readiness, learner engagement, technology issues, and inclusive practices. Lastly, throughout the interpretation process, the quantitative and qualitative results were combined to yield a comprehensive insight into the impact of AI-enriched blended learning contexts on the educational journey of students with visual impairment. The integration allowed for the study to study the measurable trends and lived experiences of participants, which further enriched the depth, validity and the practical relevance of the findings.

Result

Table 1 Distribution of Student Responses Regarding AI & Blended Learning Accessibility (N=50)

Subject	Online/Blended Learning Issue	Always (%)	Sometimes (%)	Never (%)
1.	Used AI-enabled assistive tools (e.g., screen reader, OCR app)	68	12	20
2.	Found blended learning accessible and flexible	74	10	16
3.	Teachers integrated AI or assistive tools in instruction	35	13	52
4.	Faced digital or content accessibility issues	71	11	18
5.	Reported improved independence in learning through AI tools	64	14	22
6.	Teachers received training in inclusive digital pedagogy	32	7	61
7.	Required frequent parental assistance	59	17	24
8.	Experienced enhanced motivation and confidence	66	15	19

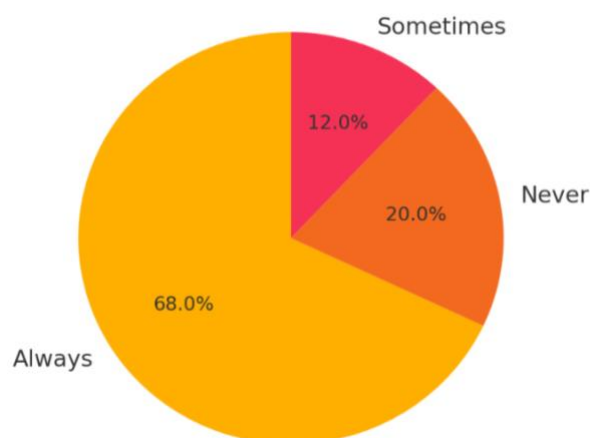


Figure 1 Used AI-enabled Tools

The quantitative results reveal that the adoption of AI-enabled and blended learning approaches among students with visual impairment (VI) has been promising yet uneven across schools. A significant 68% of respondents reported using AI-based assistive tools such as screen readers and OCR applications, indicating that technological awareness and utilization have increased among VI learners. However, the remaining one-third still lacked access to or familiarity with such tools, reflecting persistent digital inequities and affordability challenges.

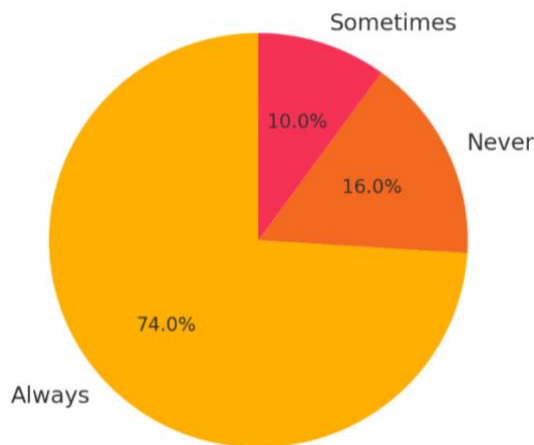


Figure 2 Blended Learning Accessible

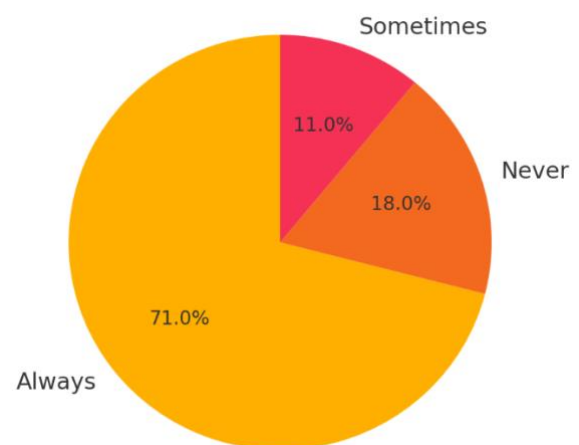


Figure 3 Faced Accessibility Issues

A larger proportion, 74%, found blended learning to be both accessible and flexible, which highlights its potential to support differentiated and self-paced learning experiences. Yet, accessibility gaps remain apparent, as 71% of students faced difficulties in accessing or navigating digital content. This finding reinforces the argument that while digital education promotes flexibility, inadequate attention to accessibility design limits its inclusiveness for visually impaired learners.

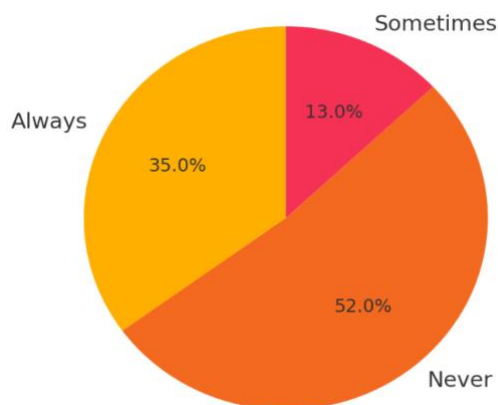


Figure 4 Teachers Integrated AI Tools

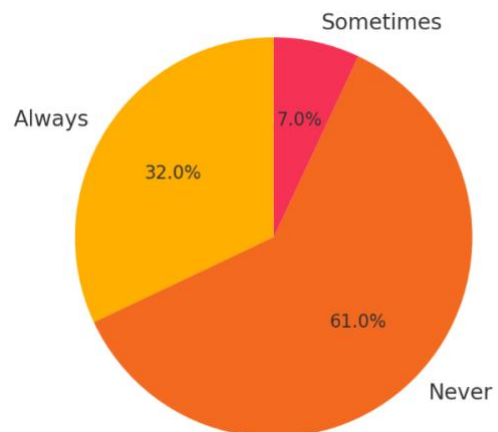


Figure 5 Teachers Trained in digital pedagogy

Teacher involvement emerged as a major concern. Only 35% of students stated that their teachers integrated AI or assistive tools in instruction, and a mere 32% confirmed that teachers had received any training in inclusive digital pedagogy. These findings point to a serious lack of teacher preparedness, echoing earlier studies emphasizing that technology alone cannot ensure inclusion without teacher competence and institutional support.

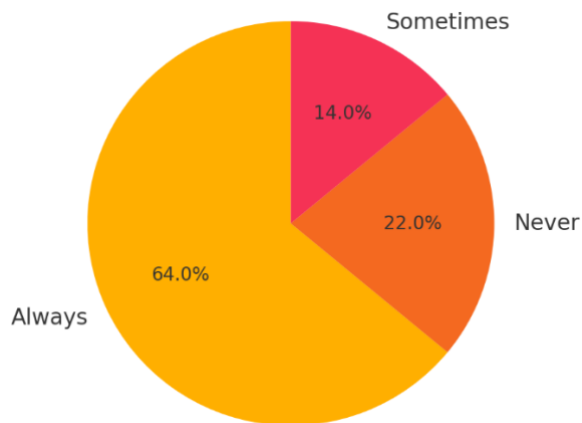


Figure 6 Improved Independence via AI

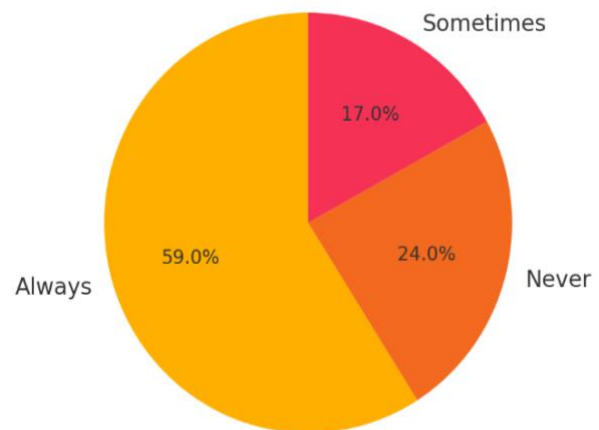


Figure 7 Required Parental Assistance

Interestingly, 64% of students reported improved independence in learning through AI tools, showing that assistive technologies have significantly enhanced self-reliance and engagement when accessible. This aligns with the principle of Universal Design for Learning (UDL), which emphasizes learner autonomy and multiple means of engagement. However, 59% still required frequent parental assistance, suggesting that lack of teacher guidance and inaccessible materials continue to force learners to depend heavily on family support.

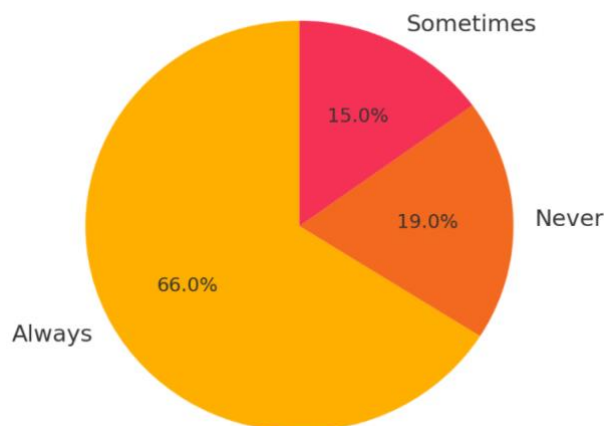


Figure 8 Enhanced Motivation & Confidence

In terms of affective outcomes, 66% of respondents experienced greater motivation and confidence through AI-enabled learning experiences, which indicates that the integration of assistive technology can have a positive psychosocial impact on learners' self-esteem and participation. Yet, without consistent teacher facilitation and inclusive design, these gains may remain situational rather than systemic.

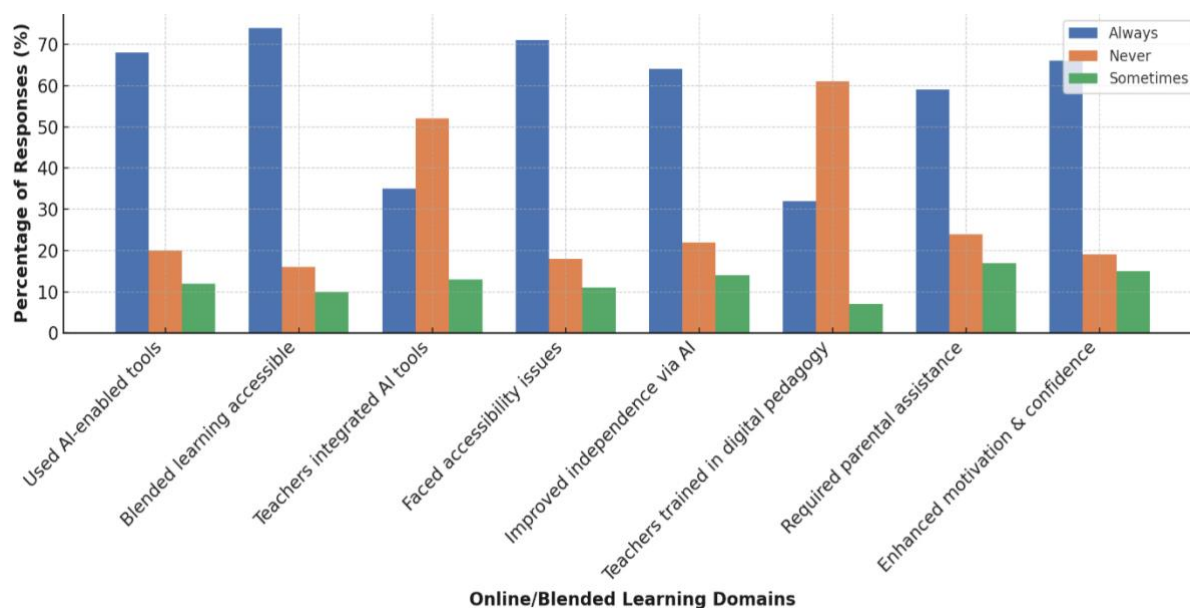


Figure 9 Comparison of Responses across all domains of AI-Integrated Blended Learning Questionnaire

The quantitative findings reveal that while AI-integrated blended learning has enhanced accessibility, flexibility, and motivation for many students with visual impairment, significant barriers remain. Although 68% of learners reported using AI-based assistive tools, only about one-third indicated that teachers actively integrated these technologies into instruction, exposing a clear gap between technological potential and pedagogical implementation. Limited teacher readiness, inconsistent accessibility of digital content, and continued dependence on parental assistance demonstrate that inclusive digital practices are not yet fully institutionalized. To realize the true potential of AI-enabled blended learning, it is essential to strengthen teacher digital literacy, ensure equitable access to assistive technologies, and embed accessibility standards within instructional design and school systems.

The semi-structured interviews with 20 participants (10 teachers and 10 parents) provided deep insights into the use of Artificial Intelligence (AI) and blended learning for students with visual impairment (VI) in inclusive educational settings. The data, analyzed through thematic framework, revealed consistent patterns that were organized into four global themes: *Accessibility and AI Readiness*, *Teacher Digital Competency*, *Student Engagement in Blended Settings*, and *Sustainable Digital Inclusion*. The following thematic table summarizes the key findings supported by representative and percentage trends of 'Yes' versus 'No' responses derived from the coded data.

Table 2 Thematic Analysis

S.No.	Open Code (Raw Data)	Sub-theme	Global Theme	Yes (%)	No (%)
1	"Voice Over app reads my books aloud so I can study independently." "AI tools help me complete assignments faster." "I use the screen reader even during exams."	AI-assisted autonomy	Accessibility and AI Readiness	68	32
2	"Teachers share PDFs but not in accessible formats." "PowerPoints have too much text and no narration." "Sometimes the screen reader skips entire lessons."	Inaccessible materials	Accessibility and AI Readiness	71	29
3	"I know how to use screen readers, but my teacher doesn't." "Teachers ask sighted peers to assist instead of using AI tools." "There was no training session for teachers on digital accessibility."	Lack of training	Teacher Digital Competency	65	35

4	<i>"Teachers use PowerPoints but rarely add audio descriptions." "They mostly rely on videos without captions." "Assignments are designed assuming we can see the visuals."</i>	Visual dependence in teaching	Teacher Digital Competency	59	41
5	<i>"Blended learning helps me attend physical and online sessions both." "If I miss a class, I can listen to the recorded audio later." "Hybrid mode gives me more flexibility."</i>	Learning flexibility	Student Engagement in Blended Settings	74	26
6	<i>"AI reading apps make subjects easier, but we don't have stable Wi-Fi." "Sometimes the internet disconnects during live sessions." "Not all students can afford smartphones or laptops."</i>	Infrastructure and connectivity gap	Student Engagement in Blended Settings	69	31
7	<i>"The government should provide free screen readers and training." "Schools should organize workshops for parents and teachers." "We need accessible digital libraries in Indian languages."</i>	Policy and systemic support	Sustainable Digital Inclusion	77	23
8	<i>"AI can't replace human support; teachers still matter most." "Technology helps, but emotional guidance comes only from teachers." "Blended learning works best when teachers and AI tools complement each other."</i>	Balanced pedagogy	Sustainable Digital Inclusion	66	34

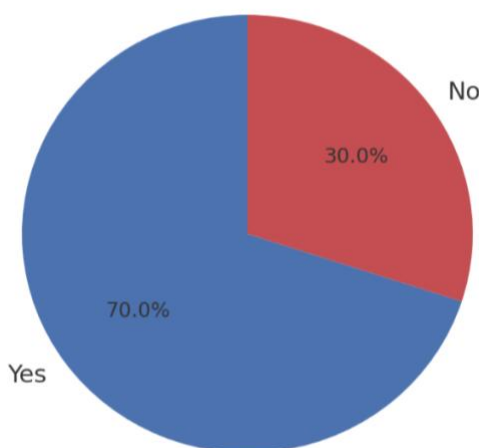


Figure 10 Accessibility and AI Readiness

The qualitative findings demonstrate that most participants acknowledged the empowering role of AI-based assistive technologies in enhancing independence, accessibility, and confidence among visually impaired learners. A large proportion (68–74%) affirmed that tools such as Voice Over, NVDA, and OCR apps significantly improved participation and learning outcomes. Yet, the benefits were often curtailed by inaccessible file formats, lack of narration in visual content, and insufficient teacher training on assistive technologies.

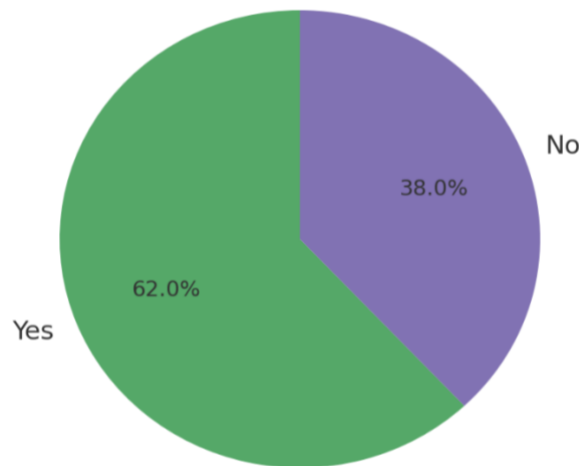


Figure 11 Teacher Digital Competency

Teacher digital competence emerged as a recurring concern. Many teachers admitted relying on sighted peers for assistance or using visually dependent instructional methods, highlighting a critical gap in inclusive pedagogy. Despite the proven potential of AI tools, untrained teachers limited their full utilization. Similarly, while students valued the flexibility of blended learning, infrastructural barriers such as poor connectivity, lack of devices, and inconsistent technical support hindered continuous engagement.

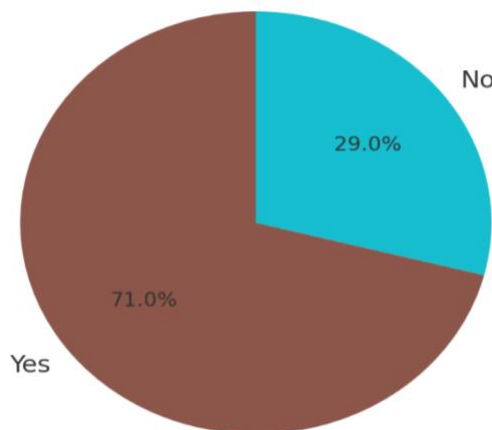


Figure 12 Sustainable Digital Inclusion

The theme of sustainable digital inclusion revealed strong agreement (77%) that government support, training programs, and accessible resource development are crucial for long-term equity. Participants emphasized that while AI enhances autonomy, human connection remains irreplaceable—underscoring the need for empathy-driven, blended pedagogies.

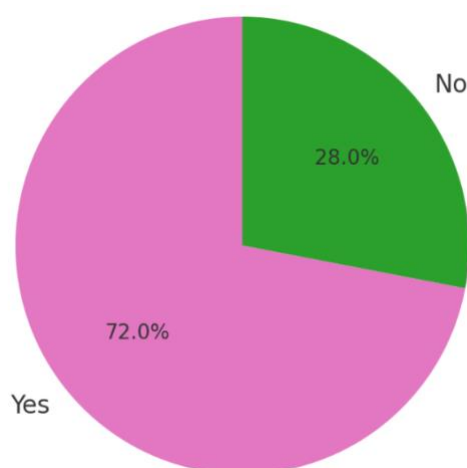


Figure 13 Student Engagement in Blended Settings

In sum, the thematic analysis underscores that AI and blended learning can effectively promote inclusion for visually impaired learners only when accompanied by accessible design, trained educators, supportive policies, and infrastructural equity. True digital inclusion depends on balancing technological innovation with the human and emotional dimensions of teaching and learning.

The findings of the study provide a comprehensive understanding of how AI-integrated blended learning environments influence accessibility, participation, and inclusion for students with visual impairment (VI) in inclusive schools across Delhi–NCR. Quantitative results indicated that the majority of visually impaired students have begun adopting AI-enabled assistive technologies such as screen readers, OCR applications, and voice-based tools. Approximately 68% of students reported using such tools regularly, and 74% found blended learning to be flexible and accessible. However, a considerable proportion (71%) continued to face digital accessibility challenges due to incompatible materials and insufficient adaptation of content. Only about one-third (35%) of respondents stated that their teachers actively used assistive technologies in instruction, and merely 32% reported that teachers had received any formal training in inclusive digital pedagogy. This gap underscores that, while technological tools are available, their pedagogical integration remains limited. Learners showed an increase in self-reliance and confidence, 64 percent of students indicated that they felt more independent with the tools of AI, and 66 percent said they felt more motivated. Still, half of them (59%), however, needed parental help often to use the Internet resources, which means that the support of a teacher and the availability of the required infrastructure are essential to maintain independence. The overall outcome of these findings is a partial and skewed achievement of the concept of digital inclusion in blended learning among the visually impaired learners.

These results were followed by the findings of qualitative analysis, which identified four related world themes, such as Accessibility and AI Readiness, Teacher Digital Competency, Student Engagement in Blended Settings, and Sustainable Digital Inclusion. Respondents affirmed that AI technologies contributed to a considerable increase in learning autonomy but also reported the constant presence of obstacles, including the inaccessibility of formats, unstable Internet connection, and the absence of the institutional support. Teachers admitted that they were not well exposed to assistive technologies and are in need of planned professional training. Both teachers and parents pointed out that AI would not be able to substitute human interaction, though technology should be used to support empathetic methods of teaching. A majority also advocated for government-led initiatives to provide affordable devices, localized assistive tools, and digital literacy programs for educators.

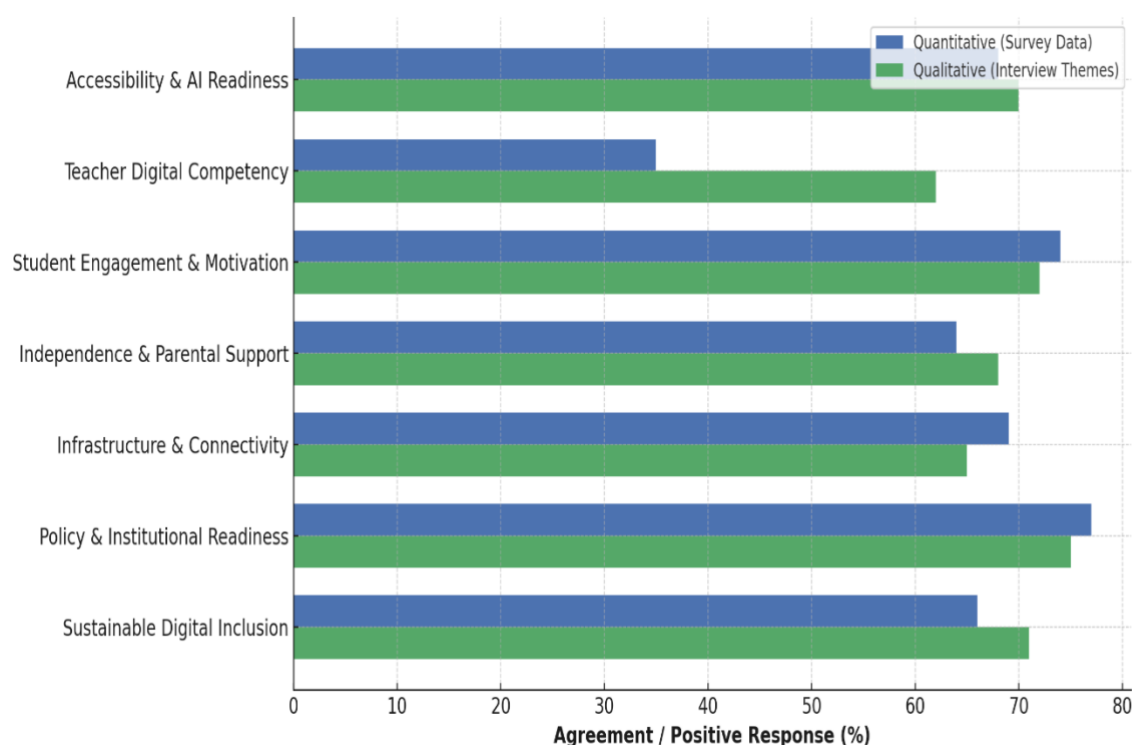


Figure 14 Combined Quantitative & Qualitative Overview of AI-Integrated Blended Learning for VI Students

Overall, both quantitative and qualitative findings converge to suggest that while AI and blended learning have substantially improved accessibility, flexibility, and engagement for students with visual impairment, full inclusion remains constrained by persistent structural, technical, and pedagogical gaps. The combined analysis demonstrates that the benefits of AI-enabled tools—such as increased learner autonomy, motivation, and participation—are evident, yet their impact is unevenly distributed due to inconsistent teacher preparedness, poor accessibility design, and infrastructural limitations.

This visual infographic clearly illustrates how survey data (quantitative) and interview insights (qualitative) align across major domains. Strong agreement was observed in areas like Accessibility and AI Readiness, Student Engagement, and Policy Support, where both datasets affirm the positive influence of assistive technologies and blended models on learner inclusion. However, lower performance trends in Teacher Digital Competency and Infrastructure Readiness reveal critical weaknesses that continue to hinder equitable implementation. When combined, the above findings support the main thesis that AI-based blended learning cannot be viewed as inherently inclusive, that is, it can only be considered inclusive in those instances when accessibility, teacher competence, and institutional readiness all interact in a harmonious manner. The solution to this gap will be through long-term investment in teacher digital literacy, policy implementation, and infrastructure building to ensure that the technological innovation does indeed become a human-centred and sustainable form of digital inclusion of all learners with visual impairments.

Discussion

Based on the results of the present study, the use of Artificial Intelligence (AI) in the field of blended learning is also highly promising to facilitate accessibility, participation, and inclusion for students with visual impairment in inclusive schools. The quantitative and qualitative evidence indicates that AI-powered assistive technology such as screen readers, Optical Character Recognition (OCR) systems, text-to-speech applications, and voice-based interfaces promote greater autonomy, engagement, and participation in digital learning environments. These results

align with the recent publications that have shown the transformative potential of AI in inclusive education. A systematic review undertaken by Melo-López et al. (2025) noted that AI has a great impact on the accessibility and personalization of learning for learners with disabilities, by adjusting the content to individual needs and minimizing access barriers. Likewise, Villatoro Moral and Moreno-Tallón (2025) found that AI-powered education technologies contribute to personalized learning experiences and enhance access to education for SEs learners.

The results also highlight how AI tools foster visual impaired students' independent, self-directed learning, confidence, and access to education. This finding is consistent with other studies regarding the use of assistive technology for visually impaired students. Persons with visual impairment benefit from the use of assistive technologies such as screen readers, text-recognition software and voice commands, which are available on a smartphone to improve access to information, communication and independent functioning, as reported by Senjam et al. (2021). With recent advances in AI technology, these advantages have been amplified with the capability to adapt content in real time, to recognize text intelligently, to describe the environment and to provide personalized learning support. Research on the use of AI tools for education in visual impairment and blindness suggests that using adaptive audio-based learning systems designed to be accessible can enhance the engagement, motivation, and participation of learners in the educational process.

While this study revealed numerous opportunities for the use of AI in education, it also uncovered significant challenges in the areas of teacher readiness, access to digital resources, and technological constraints. The results of this research align with the increasing evidence from around the world that technological innovation will not automatically lead to educational inclusion. In a systematic review of empirical studies on AI and inclusive education, Li, Yan and Zeng (2025) stated that the lack of digital infrastructure, institutional support, and teacher competencies are still key issues for effective use of AI. Similarly, in recent reviews of teacher competence for inclusive education with the use of AI, both technical competence and ethical awareness and inclusive pedagogical competence are stressed as being required for success.

One key finding from the study was that there was a limited level of confidence and competence by teachers in using AI assisted assistive technologies for learners with VI. This discovery underlines the pedagogical and human nature of inclusive education and not just a technological approach. Recent literature highlights the continuing importance of the role of the teacher as the technology-literacy link. Research indicates that the impact of AI in inclusive classrooms is significantly influenced by teacher engagement with digital tools in inclusive instruction, tailoring support, and ensuring access to learning. The benefits AI can bring may not be fully realized or distributed equitably across learners unless they are well prepared by their teachers as well as their parents.

The results of the study also support the principals of national drafts like NEP 2020 and the Rights of Persons with Disabilities (RPwD) Act, 2016 both encourage access to technology supported learning, however participants noted issues regarding inaccessible learning materials, the availability of assistive technologies to meet the needs of learners, and technical support. Likewise, issues related to provision of AT have been reported in Indian studies. A study by Senjam et al. (2021) in the schools for the blind of Delhi, showed significant differences in the availability of trained staff and ATs, reflecting a continuing systemic barrier to accessibility. The results indicate that policy measures have to be supported by institutional investments, monitoring systems and continued capacity development to move towards a world with digital inclusion.

The results also highlight the significance of Universal Design for Learning (UDL) for developing inclusive learning environments that utilize AI. Throughout the process, participants emphasized the value of making the content accessible in various formats and to assistive technologies. AI has the potential to help implement UDL principles by creating multimodal materials, adaptive feedback, personalized learning sequences, and alternative representations of information, as shown by recent research. However, academics warn that accessibility should be

built into the creation of educational materials and resources, not just be added as a technological solution to inaccessible content.

The findings of the present study have important implications for Guidance and Counselling. The results reveal that digital inclusion goes beyond technological access to include psychological, self-efficacy, social participation and educational adjustment. Students who were visually impaired described the effects of available technological supports on their confidence, independence and engagement, while the effects of barriers to access were often described as frustration, dependency and decreased participation. These observations resonate with current thinking, which focuses on counselors' roles in helping students adapt to a digital world, helping students self-advocate, support emotional learning, and provide guidance and support for students as they learn in a digital space. However, guidance and counselling need to change to cater for the psychosocial aspects of digital inclusion in addition to its academic and career guidance roles.

Overall, the study indicates that the integration of AI into blended learning can play an important role in advancing inclusive education for visually impaired students, but it requires a comprehensive ecosystem that encompasses accessible AI tools, inclusive teaching strategies, teachers' professional development, counselling support, infrastructure, and policies to ensure success. In line with the current international literature, the results confirm that technology alone is not enough to achieve inclusion; meaningful inclusion is achieved when technology is combined with human support, equity in education and the involvement of institutions. This comprehensive approach can help bring the vision of NEP 2020 'Accessible and equitable education and digitally empowered education' into reality.

Conclusion

Based on the outcomes, it is concluded that there is a need to implement the principles of Universal Design for Learning (UDL) in all digital and blended curricula, in line with accessibility standards such as WCAG 2.1, GIGW 3.0. Content should be created in a multimodal approach to meet the educational needs of all learners and to ensure that students with visual impairments can engage in meaningful learning, such as using text, audio, tactile or AI-interactive formats as needed. Improvement of teachers' digital literacy is also very important, and therefore, special attention could be given to the use of AI, AT and inclusive education in both pre-service and in-service teachers' education programmes, and in continuous professional development programmes. Digital Inclusion Cells should be created within schools for ongoing technical and pedagogical support of teachers and students. Moreover, partnerships between educational institutions, Indian EdTech startups, universities, and government bodies will help in the creation and sharing of affordable and multilingual, accessible AI-enhanced learning resources. Equitable learning opportunities will be further advanced with reliable internet connectivity, adaptive devices and an Accessible National Digital Library.

The results of the study also have implications for Guidance and Counselling. Counsellors will be instrumental in assisting students who have a visual impairment in their academic, social, and emotional and career development in AI-integrated blended learning environments. The findings of this study suggest a need for guidance and counselling services to address digital exclusion, technology-related anxiety, decreased self-confidence, social isolation, and problems with independent learning. School counsellors can play a role in encouraging students to take ownership of their own advocacy, fostering digital literacy and awareness of accessibility, helping students adjust to a technology-driven learning environment, and working with teachers and families to establish inclusive support systems. The results also highlight the need for the development of disability-inclusive counselling approaches that combine technological accessibility with psychosocial support to enable students with visual impairment to be confident and independent in the modern learning contexts.

Workshops for parents and community members should be strengthened to provide the knowledge and skills needed to support the effective use of AI enabled learning tools, alongside partnerships with non governmental organizations to advance advocacy and inclusion. At the policy level, accessibility and inclusion in digital education should be institutionalized through a National Inclusive Digital Education Framework aligned with the National Education Policy (NEP) 2020 and the Rights of Persons with Disabilities (RPwD) Act, 2016. Digital platforms and learning content should be regularly monitored to ensure accessibility, while teacher training, counseling services, educational technology, and awareness programs should be continuously improved. These measures can help address technological, pedagogical, and sociological gaps and strengthen AI integrated blended learning as an inclusive, equitable, and sustainable approach. Such efforts are particularly important for ensuring that students with visual impairments can participate meaningfully in digital learning and achieve their educational potential.

The findings should be interpreted in light of several limitations. The study involved only 50 students with visual impairments, 10 special education teachers, and 10 parents from five schools in Delhi NCR, limiting generalizability, particularly to rural and remote areas. It also focused exclusively on visual impairment and relied on self reported data, which may be influenced by recall or social desirability bias. Future research should therefore use larger and more diverse samples and compare urban and rural settings, government and private schools, and inclusive and special schools. Longitudinal and experimental studies are needed to examine academic, psychosocial, career, and social outcomes, as well as the effectiveness of teacher training and counseling interventions. Further research should also investigate AI based assistive technologies, ethical issues such as privacy and algorithmic bias, and the perspectives of parents, teachers, policymakers, counselors, and technology developers to support evidence based and inclusive digital education.

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