QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

EXPLORING THE ACCESSIBILITY LANDSCAPE OF AI-DRIVEN ASSISTIVE TECHNOLOGIES FOR VISUALLY IMPAIRED STUDENTS IN THE PROVINCE OF PUNJAB

Dr. Muhammad Javed Aftab
Assistant Professor (Special Education)
Department of Special Education (DSE)
Division of Education (DoE)
University of Education (UoE), Lahore, Punjab, Pakistan
Email: drmjavedaftab@ue.edu.pk
Anas Raza
M.Phil. Scholar (Special Education),
Department of Special Education, (DSE)
Division of Education (DoE),
University of Education (UoE), Lahore, Punjab, Pakistan.
Email: anasrazashafique@gmail.com
Asjad Saeed
M.Phil. Scholar (Special Education),
Department of Special Education, (DSE)
Division of Education (DoE),
University of Education (UoE), Lahore, Punjab, Pakistan.
Email: muhammadasjadsaeed@gmail.com

Abstract

This study investigates the accessibility status of smart devices and artificial intelligence (AI) technologies for students with visual impairment in the Province of Punjab, Pakistan. With the growing integration of digital tools in education, it is critical to assess whether visually impaired learners can equitably benefit from these advancements. Using a mixed-methods research design, data were collected from a purposive sample of 150 participants, including visually impaired students, educators, and institutional administrators from special education centers across Punjab. Quantitative findings indicate moderate availability of AI-powered assistive technologies, yet significant disparities remain in usability and infrastructure. Qualitative data further reveal key barriers such as lack of teacher training, high costs, limited localized content, and insufficient policy support. The study highlights that mere availability of smart devices does not guarantee meaningful access or inclusion. It concludes with practical recommendations for improving digital accessibility through teacher training, context-sensitive technology development, and institutional reforms. These insights are vital for shaping inclusive education policy and digital equity initiatives in special education.

Introduction

In Today's modern world many people interact with AI and Smart devices unintentionally, these devices have become a part of our lives. Now a question arises: what is AI and how it impacts our lives.Artificial intelligence (AI) is an important and emerging sub-discipline in information technology that is progressively being implemented in every field.(Journal of Librarianship and Information Science,2024,

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

M.Yousaf Ali, Salman Bin Naeem, Rubina Bhatti). Smart devices and Artificial Intelligence (AI)-powered assistive technologies have revolutionized education by offering real-time object recognition, text-to-speech conversion, and adaptive learning tools. AI refers to the ability of machines to perform cognitive tasks like thinking, perceiving, learning, problem solving and decision making.(ICT India Working Paper,2021. Nirupam Bajpai, Manisha Wadha). According to the World Health Organization (WHO), over 2.2 billion people worldwide suffer from some form of visual impairment, making accessibility a crucial issue in education.(WHO,2019). Many people don't realize they interact with AI multiple times each day. When they use navigation apps to dodge traffic,Unlock their phones with facial recognition,using ChatGPT for information, Grammarly for grammar mistakes.They are engaging with sophisticated AI systems that learn and adapt to user behavior.(Examples of AI in everyday life: the unforeseen impact on society, 2024)

This research focuses on evaluating the accessibility status of smart devices and AI-driven assistive technologies for visually impaired students in Punjab. Technology has profoundly changed education, It has greatly expanded access to education. In medieval times, books were rare and only an elite few had access to educational opportunities. Individuals had to travel to centers of learning to get an education. AI-powered tools such as screen readers, voice assistants, and smart glasses have become more advanced, their adoption in educational settings is inconsistent(An insight into assistive technology for the visually impaired and blind people: state-of-the-art and future trends, 2017). Today massive amounts of information(books, audios, images, videos) are available at one's fingertips through the internet and opportunities for formal learning are available online worldwide through Khan Academy, MOOCs, Podcasts, traditional online degree programs and more.(How has Technology changed Education, 2024). As Ai and smart devices are shadowing the world with its importance and changing lives, it also changed education in big ways, especially for students with disabilities. Smart devices like smartphones, tablets and Artificial Intelligence have made it easier for people with Visual impairments to access education. AI makes these tools even better by adding things like speech recognition, text to speech and personalised learning. Since the world is focusing more on inclusive education, it's important to see how well these technologies work in places like punjab.

This research is conducted to inspect the accessibility status of both smart devices and AI for Visually Impaired Students in Punjab,and discuss known and unknown facts of technology in Punjab schools.Despite technological advancements, visually impaired students in Punjab face multiple challenges, including high costs, limited awareness, and inadequate infrastructure to support AI-powered assistive tools . Moreover, many assistive technologies lack a user-centered design approach, making them less effective for students with different levels of visual impairment.(Poster: The Influence of Intelligent Assistive Technology on The Activities Of Daily Living of Visually Impaired People, 2022).

This research is important to discover various aspects of AI and Smart devices, while these devices hold great impact for Visually Impaired students in education also possess greater challenges and barriers that limits their usability and addressing these gaps/ barriers is essential for ensuring that visually impaired students can fully participate in the educational system.

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

Most studies on AI-based assistive technology focus on developed countries, As pakistan is an underdeveloped country, so it leaves a gap in research regarding its accessibility and effectiveness in Punjab. There is a lack of AI understanding among educators, lack of empirical data on how these technologies are being used in schools, what challenges students face, and how can we improve it.

1. How accessible are smart devices and AI-based assistive technologies for visually impaired students in Punjab?
2. How misunderstanding/ misuse of AI-based smart devices impact the teaching and learning in Special education institutes in punjab?
3. What improvements can be made to AI-driven assistive technology to enhance accessibility for visually impaired students?

This study provides empirical data on the usability and accessibility of AI-powered assistive technology in Punjab's educational institutes. First, it aims to evaluate the effectiveness of AI-driven smart devices in supporting visually impaired students. Second, it seeks to identify key barriers to adoption, such as affordability, training gaps. Third, it offers practical recommendations for educators, policymakers, and technology developers to enhance accessibility and inclusivity. By bridging these research gaps, the study will help inform future AI innovations and policy frameworks that support equitable education for visually impaired students.

Even with the rise of smart devices and AI to help all students learn, those who cannot see well in Punjab still face big hurdles with these tech tools. Issues like hard-to-reach tech, not enough setup, gaps in tech know-how, and teachers not ready yet block the use of AI tools in schools. These problems raise big worries about fair use of new tech for those with sight issues and show a need to check how accessible things are now and to find fixes that fit Punjab's needs. The goals of this study were to look at how reachable and useful AI smart devices are for students who cannot see well in Punjab schools, and to spot challenges like cost, tech know-how, and setup. It also aimed to see how aware and ready teachers are to use AI tech in classes for special needs, and to make helpful tips to make these tools work better for students with sight issues in Punjab.

Review of Related Literature

Assistive Technology for Visually Impaired Students

Helpful tech tools have made learning better for students who can't see well. Researchers like Hwang and others in 2020 say that things like wearable tech, AI apps, and sensors are key to helping people who are visually impaired. Studies show that using tools like screen readers, braille devices, and AI guides has greatly helped these students do better in school (Bhowmick & Hazarika, 2017).

New tech in the same area includes systems that give touch feedback, turn spoken words into audio right away, and translate into braille using AI. These updates are making it easier for students who can't see well to learn on their own. But, getting these tools is often hard due to money issues, not enough people know about them, and rules are not used well (Hwang et al., 2020).

Tech is always getting better, and new AI tools aim to make learning easier for these students. For example, voice helpers give help right away so students can work with digital stuff better. AI is also used to make these tools work better and fit what

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

each user needs. AI-driven touch feedback tools are also being made to help students feel digital pages better (Lukman et al., 2024). These steps are important in making learning better for everyone.

Artificial Intelligence in Assistive Technology

AI is key in help-tech by giving live text read, voice help, and item spot. Study by Lavric and others (2024) shows how joining Visible Light Talk (VLC) with AI helps the move and talk of those who cannot see (Lavric et al., 2024). Also, AI-based apps like Seeing AI, Google Lookout, and Be My Eyes are now much-used to help those who cannot see in school spots (Tsouktakou et al., 2024).

AI is used too in making smart school help for those who cannot see well. AI-run speech to text, live word show tools, and smart help systems let students who cannot see be a part of talks. More so, study points out that AI-set systems can shift to fit each one's way of learn by giving made-for-you words back and other ways of content, like braille or audio stuff (Nombakuse, 2023).

More and more AI-based learn apps are using ways that work on many senses to help students who cannot see. These systems use talk make, move-based asks, and feel-back ways to give a full learn feel. AI's work in making digital know-how better for students who cannot see is also a hot spot, with made-for-you tips and learn paths making sure each kid gets the right help in learn (Iqbal et al., 2024). AI’s chance to change help for special needs is big, as long as we fix the ways it can't be used by all.

Smart Devices and Accessibility

Smart tools like phones, tablets, and tech you can wear have changed how blind students see the world around them. Tsouktakou and others in 2024 say that AI in these tools helps each student learn in their own way, move better, and do more on their own (Tsouktakou et al., 2024). But, it's still hard for some to get and use these tools, and they may not always work with the schools' old systems (Kamal et al., 2024).

Putting AI in these tools also lets blind people do more on their own. Apps that talk, see things, and helpers you can talk to in phones help them get information fast and use it well. But, it's not easy for everyone to get these helps, especially in places far from cities or where people don't have much (Hwang et al., 2020).

New tech like smart glasses use AI to see things and help move around. This tech tells students what's around them using sound. It helps them be a part of the world more. Also, AI tools that turn text into braille let them read from big online libraries they couldn't use before (Lukman et al., 2024). AI's job in making learning open to all keeps growing. It solves big problems blind students have in usual schools.

AI and Smart Devices in Special Education

AI tools have changed how kids who can't see well learn by giving them new ways to get into their studies, such as screen readers, talking software, and smart glasses. These tools help these kids use online stuff better on their own. Research shows that tech like AI tablets and wearables give quick object naming, tell about the place

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

around, and change stuff to Braille, making class easier for them (Journal of Librarianship and Information Science, 2024).

Putting AI into schools has made more chances for these students by making learning fit just for them. AI systems change how they teach based on what each kid needs, making lessons just right for everyone. AI talking helpers, like Apple's Siri, Google Assistant, and Amazon Alexa, help with finding stuff online without using hands and getting info easy (ICT India Working Paper, 2021). Also, AI speech-to-text tools turn talking into writing, which is great for kids with more than one disability.

Challenges in Accessibility

Despite technological advancements, visually impaired students face several challenges in accessing smart devices and AI-based tools. Key barriers include:

- **Affordability**: High costs of assistive technology limit widespread adoption (Iqbal et al., 2024).
- **Lack of Training**: Limited digital literacy and training programs hinder effective utilization of AI tools (Nombakuse, 2023).
- **Infrastructure Constraints**: Inconsistent internet connectivity and lack of accessible educational materials create obstacles for students in Punjab (Kamal et al., 2024).
- **Policy Gaps**: Lack of government support and inclusive policies contribute to accessibility challenges (Bhowmick & Hazarika, 2017).
- **Digital Divide**: Unequal access to technology due to socioeconomic disparities restricts opportunities for visually impaired students (Tsouktakou et al., 2024).

To deal with these issues, we need many groups to work together: teachers, people who make rules, and those who make tech. Governments should aim to cut the cost of aids that help teach, start programs to make people know more, and build up tech resources in schools for special education (Hwang et al., 2020). More studies are a must. They should look into ways to keep giving out AI tools that assist in learning, mainly where money is tight.

Challenges in AI Adoption for Visually Impaired Students

Even with new tech steps, many big roadblocks keep AI help tools for kids who can't see from being all over the place. Money is one big wall. AI tools cost a lot, so many kids in poor places can't get them (Tech Chance Study, 2020). Also, poor setup, like bad power and little web reach, makes it hard to use AI smart tools in schools for special needs.

Then, a lot of teachers and kids don't know enough about digital tech. Many teachers haven't learned how to use AI right, so it's hard to bring it into class. Studies show that AI help tools work well if teachers get good training and lessons change right (A Look at Tech Help for the Non-seeing, 2017). Without the right lead, kids who can't see may not get all they can from AI in learning.

Another worry is if AI tech can work well in many tongues and ways of living. A lot of AI tools are made for English speakers, which cuts out kids who speak other words. Making AI tools fit for many languages is still a big thing to fix.

AI's Role in Inclusive Education

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

AI can change how we let all kids get to learn by making sure everyone has the same chances to get to learning tools. AI helps kids who can't see well by giving them fast captions and ways to hear texts, so they can learn on their own. AI also changes how teachers can help by watching how students do and then making new ways to teach, this helps everyone learn better together.

AI also makes tools that change text to Braille fast, so kids who use Braille can learn from the same books and articles as others. Tech that mixes AI with Braille screens helps these kids touch and read digital info. AI that works with many languages helps kids from all over who speak different words.

Now, AI helps these kids turn what they write by hand into digital texts that can talk back. This lets kids who can't see well join in with other kids in class and learn from the same books and talks, fast.

Technological Advancements in Assistive Learning

New AI tech, like deep learning and computer vision, help make top tools for students who can't see well. AI apps, like Seeing AI and Be My Eyes, let students move around by telling them what's near in real time. These apps can spot things, read words out loud, and talk about what's around (WHO, 2019).

Also, new steps in AI touch tech help these students use digital stuff by touch. Touch tech mimics the feel and shape of things, letting students 'see' ideas by touch. AI and 3D printing help make touch tools, like bumpy maps and charts, so hard topics like science and math are easier to get (Assistive Technology for Visually Impaired Individuals, 2022).

AI helps with quick, real-time translation too. This lets students who can't see well use school stuff from all over the world without worrying about language limits. Tools that turn speech to text and switch languages with AI make sure these students join in big school talks all over, growing their school chances.

Government Policies and Accessibility Frameworks

Government policies play a crucial role in the adoption of AI-driven assistive technologies for visually impaired students. Countries with well-developed policies on inclusive education have successfully integrated AI-powered tools into special education curricula. However, in regions like Punjab, the lack of standardized policies and funding has slowed the adoption of these technologies (Poster: The Influence of Intelligent Assistive Technology on The Activities of Daily Living of Visually Impaired People, 2022).

Several policy initiatives have aimed to improve accessibility, but challenges remain in implementation. Governments must invest in research and development of AI-based educational tools tailored to the needs of visually impaired students. Public-private partnerships can also play a critical role in making AI-powered assistive technologies more affordable and widely available.

In many developing nations, funding for special education technology remains inadequate. There is a growing need for legislation that mandates equal access to AI-powered learning tools for students with disabilities. Policies must ensure that AI

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

technologies used in education are continuously updated to reflect the latest advancements in accessibility.

Future Prospects of AI in Special Education

The use of AI in special ed looks good. We think artificial brains will help make things easier to reach. AI tools that you can wear, with cameras and sensors, could help blind students see their world better. AR and VR will make learning by using more than one sense better. It makes hard ideas easier to grab onto.

AI robots are also in the works to help blind students do everyday tasks. These robots will use AI to talk and see body movements to talk well without mix-ups. Also, better AI that can read text aloud will keep making it easier for blind students to learn from books and much much more.

AI will grow in tech-smart classrooms too. This lets blind students join in talks, tests, and fun group work just like other kids. AI that checks data will also get better at making learning fit each student better. It will spot what each student does best and what they need to work on, shaping a better way to teach.

Ethical Considerations and Equity in AI-Powered Assistive Technologies

As AI becomes more integrated into education, ethical concerns related to data privacy, algorithmic bias, and equitable access must be addressed. Researchers emphasize the need for transparency in AI development to ensure that assistive technologies do not reinforce existing inequalities (AI and Education Policy Review, 2023).

One major ethical challenge is bias in AI datasets. If training data used in AI models lacks representation of diverse user needs, assistive technologies may perform poorly for certain populations. Developers must prioritize inclusive AI design by incorporating diverse datasets and engaging visually impaired students in the co-creation of assistive tools.

Another significant concern is data privacy. AI-based assistive technologies collect vast amounts of personal data, raising questions about how information is stored and protected. Many developing countries lack comprehensive data protection laws, making it essential to establish guidelines that safeguard student data. Governments and organizations must implement ethical AI policies to ensure that assistive technologies are secure and trustworthy.

Case of Punjab: Accessibility Status

Punjab has tried to mix AI and smart tools into the school plan for kids who can't see well. Still, there are holes in making policies work and in building things up. Mateen Iqbal notes (2024) that even though AI-based school sites are up, their use by kids with limits stays low due to money and plan issues (Iqbal et al., 2024). The government has rolled out plans like digital join plans and special school plans, but their full effect is still not seen (Kamal et al., 2024).

The government in Punjab also worked with groups from around the world to bring AI school tools to special schools. But, reports show that how much students and teachers know and take to these tools is still small. There is also a call for answers that fit the local talk and way of life, making sure AI tools meet the needs of all kinds of people in Punjab (Nombakuse, 2023).

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

More research in Punjab could spot the real needs of kids who can't see in that area. Looking at how other places do things could shed light on the best ways to let kids get to things and mix tech. Also, using AI in country schools should be looked at more to fill the city-country split in using helpful tech. Working hand in hand with private groups could be key in growing reach plans and keeping tech help going for kids who can't see in Punjab.

Research Methodology

Research Design

This study employed a mixed-methods research design to explore the accessibility of smart devices and AI-based educational tools for students with visual impairments in Punjab, Pakistan. The rationale behind using a mixed approach was to gather both measurable data and in-depth insights into teacher perceptions.

Population and Sampling

The participants comprised special education teachers currently working in government or private institutions in Punjab. A total of 8 teachers responded to the questionnaire, including both male and female educators with varying levels of teaching experience.

Research Tool Development

Data were collected using a structured questionnaire designed in Google Forms. The questionnaire included:

- Closed-ended questions to collect quantitative data on availability and use of smart devices and AI.
- Open-ended questions to gather qualitative insights into teachers' experiences, perceptions, and suggestions.

The questionnaire was reviewed by two field experts to ensure content validity.

Reliability of ASSDAI Scale

Scale	Cronbach's Alpha	N	N of Items
ASSDAI Scale	.712	150	12

Above table presents the reliability statistics for the ASSDAI scale. The Cronbach's Alpha value for the scale is 0.712, based on 12 items. A Cronbach's Alpha value of 0.712 indicates an acceptable level of internal consistency, suggesting that the items in the ASSDAI scale reliably measure the same underlying construct. In social science research, a value above 0.7 is generally considered acceptable, meaning that the scale can be considered reliable for further analysis and interpretation.

Data Collection & Analysis

The questionnaire link was shared with special education teachers via email and WhatsApp. Participation was voluntary, and anonymity was ensured. Responses were collected over a two-week period.

The data were analyzed in two phases: Closed-ended responses were analyzed using descriptive statistics (frequencies and percentages) to understand general trends in accessibility, usage, and awareness levels regarding AI and smart devices. Open-

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

ended responses were analyzed using thematic analysis, following Braun and Clarke's (2006) six-step framework. These steps included familiarization with the data, coding, generating initial themes, reviewing themes, naming themes, and producing the report. This approach allowed for the identification of key patterns in teacher perceptions and challenges faced.

Table 4.1. Demographic Information of Students with Visual Impairment

Demographic Variables	Value	Frequency	Percentage
Gender	Male	50	33.3
	Female	100	66.7
Age	21–30	80	53.3
	31–40	45	30.0
	41–50	10	6.7
	Above 50	15	10.0
Qualification	Bachelor's Degree	30	20.0
	Master's Degree	60	40.0
	M.Phil./Ph.D.	60	40.0
Designation	College Lecturer	20	13.3
	Primary School Teacher	40	26.7
	Secondary School Teacher	35	23.3
	Special Education Teacher	55	36.7
Sector	Government	65	43.3
	Private	60	40.0
	Special Education Institute	25	16.7

Table 4.1 presents the demographic distribution of students with visual impairment who participated in the study. The data is categorized according to gender, age, qualification, designation, and sector of employment. In terms of gender, the majority of the participants were female (66.7%, n = 100), while males comprised 33.3% (n = 50).

Regarding age, the largest proportion of participants fell within the 21–30 age bracket, accounting for 53.3% (n = 80). This was followed by 31–40 years (30.0%, n = 45), above 50 years (10.0%, n = 15), and the smallest group being those aged 41–50 years (6.7%, n = 10). When considering educational qualifications, equal proportions of the participants (40% each) held either a Master's degree or an M.Phil./Ph.D., with the remaining 20% (n = 30) holding a Bachelor's degree. The designation of participants showed that the highest number were Special Education Teachers (36.7%, n = 55), followed by Primary School Teachers (26.7%, n = 40), Secondary School Teachers (23.3%, n = 35), and College Lecturers (13.3%, n = 20). In terms of the **sector** in which the participants were employed, 43.3% (n = 65) were working in government institutions, 40.0% (n = 60) in private institutions, and the remaining 16.7% (n = 25) were affiliated with Special Education Institutes.

Table 4.2 Training

Statement	Values	Frequency	Percentage

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

Have you received training in using assistive or AI-based educational	Yes	125	83.3
	No	25	16.7
		150	100

Table 4.2 provides information regarding whether the students with visual impairment had received any form of training relevant to their educational or professional development. Out of a total of 150 participants, a significant majority (83.3%, $n = 125$) reported having received training, while only 16.7% ($n = 25$) indicated that they had not undergone any training.

Table 4.3 Awareness and Usage of Smart Devices & AI Tools

Statement	Values	N	Frequency	Percentage %	Mean	Std. Dev
Do you think that you are adequately familiar with smart devices (smartphones, tablets, laptops) used in education?	Neutral	150	10	6.7	4.30	.588
	Agree		85	56.7		
	Strongly Agree		55	36.7		
Do you agree that you are familiar with AI-powered tools used in special education (e.g., screen readers, speech-to-text apps)?	Strongly Disagree	150	5	3.3	3.87	.924
	Disagree		5	3.3		
	Neutral		30	20		
	Agree		75	50		
	Strongly Agree		35	23.3		
Do you think visually impaired students at your institution frequently use smart devices?	Strongly Disagree	150	5	3.3	3.77	.886
	Disagree		5	3.3		
	Neutral		35	23.3		
	Agree		80	53.3		
	Strongly Agree		25	16.7		
Do you think that AI-based tools (like text-to-speech or object recognition apps) used in your classroom? .	Strongly Disagree	150	5	3.3	3.83	.901
	Disagree		10	6.7		
	Neutral		15	10.0		

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

	Agree		95	63.3		
	Strongly Agree		25	16.7		

Table 4.3 presents the responses of participants regarding their awareness and usage of smart devices and AI-powered tools in the context of special education for students with visual impairment. In response to the statement "Do you think that you are adequately familiar with smart devices (smartphones, tablets, laptops) used in education?", the majority of participants agreed (56.7%, *n* = 85) or strongly agreed (36.7%, *n* = 55), with only a small proportion remaining neutral (6.7%, *n* = 10). The mean score was 4.30 with a standard deviation of 0.588, indicating a generally high level of familiarity with smart devices among participants and low variability in responses. For the statement "Do you agree that you are familiar with AI-powered tools used in special education (e.g., screen readers, speech-to-text apps)?", half of the participants agreed (50%, *n* = 75) and 23.3% (*n* = 35) strongly agreed. A smaller number remained neutral (20%, *n* = 30), while very few disagreed (3.3%, *n* = 5) or strongly disagreed (3.3%, *n* = 5). The mean response was 3.87, with a standard deviation of 0.924, showing a generally positive perception but with slightly more variation compared to the previous item. Regarding the frequency of smart device use by visually impaired students, a majority either agreed (53.3%, *n* = 80) or strongly agreed (16.7%, *n* = 25) with the statement "How frequently do visually impaired students at your institution use smart devices?". About 23.3% (*n* = 35) were neutral, while a small percentage disagreed or strongly disagreed (3.3% each). The mean score of 3.77 and standard deviation of 0.886 indicate a moderate to high level of usage with moderate variation in responses. Lastly, participants responded to the statement "Educational software tailored for VIC is accessible." Most agreed (63.3%, *n* = 95) or strongly agreed (16.7%, *n* = 25), with a small proportion remaining neutral (10%, *n* = 15) or disagreeing (6.7%, *n* = 10) and strongly disagreeing (3.3%, *n* = 5). The mean score was 3.83, and the standard deviation was 0.901, again showing a generally positive view regarding software accessibility with moderate variability.

Table 4.4. Accessibility and Usability

Statement	Values	N	Frequency	Percentage %	Mean	Std. Deviation
Do you think that smart devices for visually impaired students are accessible?	Neutral	150	10	6.7	3.03	.408
	Agree		125	83.3		
	Strongly Agree		15	10		
Are the AI tools used at your institute suitable for the learning needs of visually impaired students?	Strongly Disagree	150	5	3.3	3.70	.865
	Disagree		10	6.7		
	Neutral		25	16.7		
	Agree		95	63.3		

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

	Strongly Agree		15	10		
Do you think that visually impaired students at your institute face challenges in using smart devices and AI tools?	Neutral	150	5	3.3	4.07	.360
	Agree		130	86.7		
	Strongly Agree		15	10		
Do you think smart devices in your institute support screen readers, Braille devices, or other accessibility features?	Disagree	150	10	6.7	2.86	.618
	Neutral		20	13.3		
	Agree		115	76.7		
	Strongly Agree		5	3.3		

Table 4.4 outlines the participants' perceptions regarding the accessibility and usability of smart devices and AI tools for visually impaired students. For the statement "In your opinion, how accessible are smart devices for visually impaired students?", the majority of respondents (83.3%, *n* = 125) agreed that smart devices are accessible, and 10% (*n* = 15) strongly agreed. A small portion (6.7%, *n* = 10) remained neutral. The mean score was 3.03 with a standard deviation of 0.408, indicating moderate agreement with relatively low variability in responses. In response to "Are the AI tools used at your institute suitable for the learning needs of visually impaired students?", 63.3% (*n* = 95) agreed and 10% (*n* = 15) strongly agreed. However, 16.7% (*n* = 25) were neutral, while 6.7% (*n* = 10) disagreed and 3.3% (*n* = 5) strongly disagreed. The mean was 3.70, with a standard deviation of 0.865, suggesting a generally positive view but with noticeable variability. Regarding the statement "Do you think that visually impaired students at your institute face challenges in using smart devices and AI tools?", a significant majority (86.7%, *n* = 130) agreed, and 10% (*n* = 15) strongly agreed. Only a small percentage (3.3%, *n* = 5) remained neutral. The mean response was 4.07, with a low standard deviation of 0.360, reflecting strong agreement and consistency among responses. Lastly, in response to "Do you think smart devices in your institute support screen readers, Braille devices, or other accessibility features?", most participants agreed (76.7%, *n* = 115), while 13.3% (*n* = 20) were neutral and 6.7% (*n* = 10) disagreed. Only 3.3% (*n* = 5) strongly agreed. The mean score was 2.86, with a standard deviation of 0.618, indicating relatively lower confidence in the availability or effectiveness of specific accessibility features.

Table 4.5. Institutional and Policy Support

Statement	Values	N	Frequency	Percentage %	Mean	Std. Deviation
Your institution provides training to teachers for using assistive technology or AI tools.	Strongly Disagree	150	5	3.3	3.50	.995

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

	Disagree		25	16.7		
	Neutral		25	16.7		
	Agree		80	53.3		
	Strongly Agree		15	10.0		
Is there any policy in place in your institute that promotes the use of accessible technologies for students with disabilities?	Strongly Disagree	150	5	3.3	3.73	.895
	Disagree		15	10.0		
	Neutral		10	6.7		
	Agree		105	70.0		
	Strongly Agree		15	10.0		
Do you believe that training of teachers on assistive technologies will help improve inclusivity?	Agree	150	105	70.0	4.30	.460
	Strongly Agree		45	30.0		
Government and policymakers should invest more in AI-based technologies for special education.	Disagree	150	5	3.3	4.20	.705
	Neutral		10	6.7		
	Agree		85	56.7		
	Strongly Agree		50	33.3		

Table 4.5 presents participants' responses regarding the institutional and policy-level support for the use of assistive technologies and AI tools in special education, particularly for students with visual impairments. Regarding the statement "Your institution provides training to teachers for using assistive technology or AI tools," more than half of the participants (53.3%, *n* = 80) agreed, and 10.0% (*n* = 15) strongly agreed. Meanwhile, 16.7% (*n* = 25) were neutral, and another 16.7% disagreed. Only 3.3% (*n* = 5) strongly disagreed. The mean score was 3.50, with a standard deviation of 0.995, indicating a moderately positive perception but with some variation in institutional practices. In response to the statement "Is there any policy in place in your institute that promotes the use of accessible technologies for students with disabilities?", a significant majority (70.0%, *n* = 105) agreed, and 10.0% (*n* = 15) strongly agreed. Fewer respondents were neutral (6.7%, *n* = 10), disagreed (10.0%, *n* = 15), or strongly disagreed (3.3%, *n* = 5). The mean score was 3.73, and the standard deviation was 0.895, reflecting broad agreement with moderate variability. For the statement "Do you believe that training of teachers on assistive technologies will help improve inclusivity?", all participants either agreed (70.0%, *n* = 105) or strongly agreed

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

(30.0%, *n* = 45). There were no neutral or negative responses. This resulted in a high mean score of 4.30 and a low standard deviation of 0.460, indicating strong consensus on the importance of teacher training for promoting inclusive education. Lastly, when asked whether "Government and policymakers should invest more in AI-based technologies for special education," the majority agreed (56.7%, *n* = 85) or strongly agreed (33.3%, *n* = 50). Only a small number were neutral (6.7%, *n* = 10) or disagreed (3.3%, *n* = 5). The mean score was 4.20, with a standard deviation of 0.705, showing a strong overall agreement with slightly more variability.

Qualitative Analysis

Initial Codes

Question	Example Response	Initial Codes
Accessibility of smart devices	"Smart devices are largely inaccessible…"	Lack of access, poor usability
Features available	"Screen reader software…"	Screen readers, braille displays
Challenges	"Limited training…"	Training gaps, lack of awareness
Use of AI	"AI-powered tools like Seeing AI…"	AI screen readers, object recognition
Benefits	"Enhance independence…"	Independence, enhanced learning
Limitations	"Privacy issues…"	Data privacy, lack of infrastructure
Improvements	"By improving accessibility…"	More inclusive design, better access

Themes

From the codes, we begin grouping them into broader **themes**:

Theme	Codes Covered
Accessibility Barriers to Smart Devices	Lack of devices, affordability issues, usability limitations
Empowering Learning Through AI	Support learning, independence, accessibility
Training and Support Deficits	Lack of teacher/student training, missing tools
Essential Assistive Technology Features	Screen readers, braille displays, voice commands
Challenges and Ethical Concerns	Privacy, limited AI scope, software bugs
Opportunities to Enhance Inclusion with AI	Need for more training, localized AI, inclusive policies

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

Theme 1: Accessibility Barriers to Smart Devices

Most participants indicated that smart devices are either *inaccessible* or *partially accessible* to students with visual impairments. Challenges included lack of availability, affordability, and technical limitations in local contexts.

"Smart devices are largely inaccessible to students..."

"Lack of access to smart devices causes trouble…"

Theme 2: Empowering Learning Through AI

Participants acknowledged the transformative role of AI in making learning accessible. Tools such as *Seeing AI*, *Be My AI*, and AI-powered screen readers were frequently cited as empowering tools for visually impaired students.

"AI-powered tools like Seeing AI, Be My AI... help them to study independently."

"AI helps them a lot in learning and gaining knowledge…"

Theme 3: Training and Support Deficits

Respondents highlighted a lack of training among both students and teachers. This gap limited effective use of AI-based tools and smart devices, even when they were available.

"Limited training in using assistive technology…"

"Teachers have a lack of access and training in AI tools."

Theme 4: Essential Assistive Technology Features

Frequently mentioned features included *screen readers*, *text-to-speech*, and *refreshable Braille displays*. Participants stressed the need for these to be pre-installed and localized for native language use.

"Screen reader software is very helpful…"

"These technologies offer screen reading, Braille displays, voice commands…"

Theme 5: Challenges and Ethical Concerns

Concerns were raised about the *privacy* of users, *software limitations*, and *lack of support structures*. These issues created hesitation in fully embracing AI in classrooms.

"I think privacy issues…"

"Some tools for visually impaired students are not advanced enough..."

Theme 6: Opportunities to Enhance Inclusion with AI

Teachers suggested that increased access to AI tools, government support, localized applications, and teacher training could significantly improve inclusivity.

"AI can improve accessibility and inclusivity for visually impaired students."

"By improving accessibility to AI, it will help in better education."

Discussion

This study examined the accessibility and integration of smart devices and AI-based educational tools for students with visual impairments in Punjab, Pakistan, using a mixed-methods design. The quantitative data gathered through descriptive statistics using SPSS, alongside qualitative responses analyzed thematically, offered a comprehensive understanding of both the availability and the practical usability of assistive technologies in special education contexts.

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

Interpretation of Quantitative Findings

Oools, with 73.3% agreeing or strongly agreeing that they were familiar with such tools (M = 3.87, SD = 0.924). Additionally, 70% agreed that educational software tailored for visually impaired children is accessible (M = 3.83, SD = 0.901).

However, the frequency and effective use of these tools were not without complications. Despite positive views on accessibility, 86.7% of respondents acknowledged that students with visual impairments face challenges while using smart devices and AI tools (M = 4.07, SD = 0.360), pointing to deeper usability issues beyond availability.

Institutional and policy support showed mixed outcomes. While a majority confirmed the existence of policies promoting accessible technologies (M = 3.73, SD = 0.895), only 63.3% felt their institutions provided sufficient training for teachers in assistive technologies (M = 3.50, SD = 0.995). Notably, respondents overwhelmingly agreed that government and policymakers should invest more in AI-based technologies for special education (M = 4.20, SD = 0.705), and that teacher training is vital for fostering inclusivity (M = 4.30, SD = 0.460).

Integration of Qualitative Findings

Thematic analysis enriched the quantitative findings by providing contextual depth. Six major themes emerged:

- **Accessibility Barriers to Smart Devices:** Teachers noted that while devices may be present, usability is often limited due to affordability, unfamiliarity, or lack of adapted features.

  Empowering Learning Through AI: Tools such as Seeing AI and screen readers were praised for promoting independence and improving learning experiences.

- **Training and Support Deficits:** Many respondents emphasized the lack of both teacher and student training as a critical barrier to effective implementation.
- **Essential Assistive Features:** Commonly used tools included screen readers, text-to-speech software, and refreshable Braille displays.
- **Challenges and Ethical Concerns:** Participants mentioned privacy, lack of localized content, and limited infrastructure as recurring challenges.
- **Opportunities for Inclusive AI:** Suggestions included enhanced government funding, professional development programs, and development of culturally and linguistically appropriate technologies.

These qualitative insights confirm and contextualize the SPSS results. For example, while 83.3% of respondents claimed that smart devices are accessible, qualitative feedback revealed concerns about how accessible they truly are for everyday academic tasks. Similarly, while many participants felt familiar with AI tools, they also acknowledged a lack of structured training and institutional guidance.

Findings

Findings

Most participants reported a strong understanding and familiarity with smart devices such as smartphones, tablets, and laptops used in educational settings. Similarly, a majority also expressed awareness of AI-powered tools like screen readers

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

and speech-to-text applications. This suggests a generally informed participant group regarding educational technologies for students with visual impairments.

Respondents largely agreed that visually impaired students at their institutions do make use of smart devices. However, the reported frequency of use varied, with some participants unsure or less confident about consistent usage across the board. A clear majority of participants believed that smart devices are accessible to visually impaired learners and that the AI tools used are generally appropriate for meeting their learning needs. Nevertheless, some participants expressed reservations about how well these tools are tailored for specific challenges faced by visually impaired students.

There was strong agreement that visually impaired students encounter challenges while using smart devices and AI tools. These challenges were attributed to usability issues, limited access to supportive features, and a lack of consistent infrastructure. While many agreed that their institutions support features like screen readers and Braille devices, confidence in the availability and effectiveness of these tools was not uniformly high. Some respondents questioned whether these features were fully functional or integrated.

Over half of the participants stated that their institutions offer teacher training on assistive technologies. Additionally, many acknowledged the existence of policies promoting the use of accessible technologies for students with disabilities, although the degree of implementation varied. There was unanimous agreement that teacher training plays a key role in enhancing inclusive education. Participants emphasized that equipping educators with the skills to use assistive technologies would directly benefit students with visual impairments. Most participants believed that government bodies and policymakers should increase investment in AI-based solutions for special education. There was a strong sense that such investment could bridge existing gaps in access and inclusivity.

Participants reported that many smart devices are not easily accessible to visually impaired students, due to either high costs, inadequate distribution, or complex interfaces. Tools like Seeing AI and other AI-powered applications were seen as empowering, helping students gain independence and confidence in their learning processes. A recurring theme was the absence of adequate training for both teachers and students. Even where devices were available, the lack of hands-on support limited their effective use. Key assistive technology features such as screen readers, Braille displays, and voice commands were highlighted as essential. There was a call for these tools to be better integrated and localized in terms of language and cultural context. Some concerns were raised about data privacy, software reliability, and the readiness of AI tools in local educational environments. Participants offered hopeful suggestions, including greater teacher training, improved AI design for accessibility, and stronger institutional and policy support to create more inclusive learning environments.

Conclusion

This mixed-methods study underscores the growing presence of smart devices and AI-based tools in special education in Punjab, Pakistan. Quantitative data confirmed broad awareness and availability of such technologies, while qualitative analysis highlighted gaps in usability, training, and contextual accessibility. The convergence of both data sets indicates that access to technology is not synonymous with inclusion. While assistive devices and AI tools offer transformative potential for students with visual impairments, their effectiveness is contingent on several factors:

QUALITATIVE RESEARCH JOURNAL FOR SOCIAL STUDIES
ISSN Online: 3006-4686, ISSN Print: 3006-4678
Volume No: 02 Issue No: 02 (2025)

- Comprehensive training programs for educators.
- Localized software with culturally relevant content.
- Reliable institutional and policy support.
- Infrastructure investments to ensure functionality and equity.

Ultimately, for AI and smart devices to act as true enablers of inclusive education, systemic barriers must be addressed. The findings of this study advocate for a policy shift toward capacity-building, contextual innovation, and inclusive digital transformation in special education.

Recommendations

The study shows us that we should make three main moves to help students in Punjab who can't see well use AI and smart devices better:

First, we need big programs to train teachers. They must know about tech that can help and also how to use it in classes. Giving them regular, hands-on workshops and ongoing ways to learn more can close the gap in use and let teachers help all kinds of students better. Second, we must make tech that fits the local setting, like AI tools and apps in local languages and that fit local culture. Making software and content that show the real life of students in Punjab will make them care more and use it better. This makes sure tech helps and is easy to get to. Lastly, we need policies and support from institutions to keep using smart tech in schools for special needs. This means putting money into schools that are easy for everyone to use, helping pay for devices and their upkeep, and having fair tech rules that focus on treating everyone the same. Working together—government, schools, and tech makers—is key to making AI and smart devices work well for education that includes everyone.

References

Bajpai, N., & Wadha, M. (2021). *Artificial intelligence in education: The impact on accessibility and inclusivity*. ICT India Working Paper.

Bhowmick, A., & Hazarika, S. M. (2017). An insight into assistive technology for the visually impaired and blind people: State-of-the-art and future trends. *Springer*.

Gupta, M., Srivastava, N., & Singh, A. I. (2023). *Emerging trends in artificial intelligence education: Advancements, opportunities, and impact on educational technology*.

Hwang, J., Kim, K. H., Hwang, J. G., Jun, S., & Yu, J. (2020). Technological opportunity analysis: Assistive technology for blind and visually impaired people. *IEEE Access*.

Iqbal, M., Khan, N. U., & Imran, M. (2024). The role of artificial intelligence in transforming educational practices. *Qlantic Journal of Social Sciences and Humanities*.

Johnson, P. (2024). How technology has changed education: Digital transformation in learning environments. *Educational Review Journal*.

Kamal, H., Aslam, S., & Faisal, O. (2024). Analyzing AI's role in promoting diversity and inclusivity within educational systems. *Review of Applied Management and Social Sciences*.

Lim, T., Michelle, L., & Sawapna, G. (2023). Ethical considerations in AI-powered assistive technologies. *International Journal of Education Policy*.

Lukman, R. Y. B., Angreani, D., & Alamsyah, M. (2024). The use of artificial intelligence in the development of vision aids for the visually impaired. *Universitas Muhammadiyah Makassar*.

Nombakuse, R. (2022). Poster: The influence of intelligent assistive technology on the activities of daily living of visually impaired people. *University of Cape Town*.

Nombakuse, R. (2023). The influence of intelligent assistive technology on the activities of daily living of visually impaired people. *University of Cape Town*.

Rashid, S. M. M. (2024). Assistive technology for visually impaired individuals: A systematic literature review. *Sensors Journal*.

Smith, J., & Lee, R. (2024). Examples of AI in everyday life: The unforeseen impact on society. *AI & Society Journal*.

Tsouktakou, A., Chorti, A., & Hamouroudis, A. (2024). The use of artificial intelligence in the education of people with visual impairment. *World Journal of Advanced Engineering Technology and Sciences*.

World Health Organization. (2019). *Global data on visual impairment*. WHO Publications.