

Barriers to Assistive Technology Adoption Among Visually Impaired Students in Pakistani Higher Education

Maryam Ahmad

MS Applied Linguistics, FAST National University of Computer and Emerging Sciences, Lahore, Pakistan

Corresponding author: Maryam Ahmad (Email: Maryamsyed654@gmail.com)

Received: 14/02/2026, Revised: 18/04/2026, Accepted: 14/05/2026

ABSTRACT

Assistive technology (AT) promises significant opportunities for enhancing educational access and opportunities for visually impaired (VI) students, but this has yet to be experienced in Pakistani higher education. Nationally, it is estimated that 9 million people have some visual impairment (Junaidi, 2022), with only 10% of those who require assistive devices worldwide having access to them (WHO, 2022). This deficit is exacerbated in Pakistan given the rigid curriculum structure in higher education institutions which is based on print and lectures, lack of AT resources, including braille and audio materials, and the absence of a national policy that requires AT integration into the higher education curriculum. This paper reviews existing literature on AT accessibility, use and barriers for VI students of colleges and universities in Pakistan in light of the Technology Acceptance Model (TAM). Based on research examining factors that limit VI students' perceived ease of use and perceived usefulness of the available AT tools, this review considers the intersection of financial constraints, technological obsolescence, linguistic incompatibility, preparedness of educators, policy gaps, and social stigma. This review is different from the previous works which had studied these barriers individually in Pakistan. This review combines all these barriers in a unified TAM framework to understand how structural, cultural and psychological factors collectively inhibit AT adoption. With the basis of this synthesis, the paper suggests strategies at the government, institutional and community level for increasing the access to AT and building inclusive higher education for VI students in Pakistan.

Keywords: Assistive Technology, Visual Impairment, Higher Education, Pakistan, Technology Acceptance Model, Inclusive Education

1. Introduction

The World Health Organization (WHO, 2022) estimates that over 2.2 billion individuals worldwide suffer from some kind of visual impairment, and that many of them do not have proper access to schooling and rehabilitation services. There are about 9 million people with vision-related problems in Pakistan (Junaidi, 2022). As educational environments across the world become more digitized, assistive technologies play an increasingly important role in guaranteeing fair access for students with disabilities, particularly those with visual impairments. In nations like Pakistan, where over 9 million individuals suffer from some sort of visual impairment (Junaidi, 2022), the distribution and successful use of AT technologies is not simply an educational method, but a fundamental human right. The actual implementation of inclusive education is still patchy and not adequately funded, despite international affirmation like the United Nations Convention on the Rights of Persons with Disabilities (UNCPRD, 2006) and Pakistan's constitutional Article 25-A, which provides education for all.

Despite these legislative foundations and remarkable advancements in AT devices around the world from screen readers and Braille displays to smartphone apps like KNFB Reader and Be My Eyes, VI students in Pakistan continue to face structural, pedagogical, cultural, and technological barriers that impede their educational progress and social inclusion. The underlying issue that this study seeks to answer is: What are the barriers that VI students confront in effectively adopting and using assistive technology?



This study offers a comprehensive analysis into the accessibility, use and challenges related to assistive technology (AT) for VI students in Pakistani institutions, with an emphasis on the transformative potential of AT products such as KNFB Reader, TapTapSee, Supersense, Be My Eyes, and NVDA. This research is based on the Technology Acceptance Model (TAM), which suggests that two major factors perceived ease of use and perceived usefulness—determine an individual's chance of adopting new technology. These characteristics will be utilized to investigate the intricate interactions between VI students and their educational environments in order to understand why AT adoption remains low.

2. Literature Review

2.1 Theoretical Framework: Technology Acceptance Model (TAM)

The study was informed by the Technology Acceptance Model (TAM). Technology Acceptance Model (Davis, 1989) has been one of the most influential models of technology acceptance, with two primary factors influencing an individual's intention to use new technology: perceived ease of use and perceived usefulness. Several multi-disciplinary studies have used the TAM as a grounding framework, either in its original form (Davis, 1989) or in the extended model (Venkatesh & Davis, 2003) TAM is emerged as a useful framework for explaining satisfaction with the internet as an educational delivery medium (Arbaugh, 2002). Davis and Wong (2007) found that perceived usefulness and ease of use had moderate effects on student intentions (Davis & Wong, 2007). TAM is a well-established theoretical model that helps explain the factors influencing individuals' acceptance and adoption of technology. It provides a comprehensive framework for understanding users' attitudes, beliefs, and behaviors towards a specific technology or system.

Davis (1989) established the Technology Acceptance Model (TAM), which provides as a theoretical lens through which to examine the problems that VI students face. TAM proposes that the possibility of technology adoption is largely driven by two interconnected perceptions:

1. **Perceived usefulness:** A person's belief that employing a specific system would improve their performance.
2. **Perceived Ease of Use:** The belief that utilizing the system is effortless.

For VI students, the adoption of AT is driven not just by these attitudes but also by extrinsic factors such as socioeconomic restraints, institutional support, policy implementations, and cultural perspectives. By combining the TAM with empirical findings, this study investigates how these externalities reduce the perceived ease and usefulness of AT for VI learners. In the case of VI students, TAM overlaps with concerns of accessibility, training, and affordability. A student may find a screen reader theoretically beneficial, but if it is incompatible with their language of instruction or needs extensive digital abilities to use, the apparent ease of use is considerably reduced. Furthermore, socio-emotional variables such as stigma or a lack of support from instructors and family members can have a substantial impact on behavioral intention, which is an important outcome variable in TAM.

2.2 The Educational and Technological Landscape of VI Students in Pakistan

To contextualize the difficulties, we must first understand the educational and technical environment in which VI students in Pakistan operate. Although Pakistan signed the UNCRPD in 2011, there has been little progress in inclusive education. Most educational institutions do not have the infrastructure, resources, or skilled people required to properly integrate students with impairments. As current AT tools are inaccessible, many VI students rely mainly on antiquated technology or simple approaches such as readers or dictation.

Pakistan's educational system is predominantly developed for sighted students. The majority of learning resources are printed, teaching methods are visual, and test formats are inaccessible to those with visual impairments. Even colleges labelled as “inclusive” frequently do not provide Braille or audio resources. An inflexible curriculum that does not permit alternate learning styles further reduces accessibility, making it harder for VI students to participate meaningfully in the learning process.

Technological gaps worsen this problem. Most AT tools used worldwide are not only expensive, but also linguistically unsuitable with Pakistan's multilingual environment. Students who are fluent in Urdu other regional languages struggle to use English-based technologies. Furthermore, inconsistent internet connections and frequent power outages impede the use of web-based AT apps.

3. Discussion

3.1 Access and Availability of Assistive Technology

Accessibility is the most crucial hurdle in integrating AT into the academic lives of VI students in Pakistan. According to (WHO, 2022), only around 10% of persons who use assistive devices worldwide have access to them. This figure is most likely lower in Pakistan due to a variety of institutional and economic restrictions.

3.2 Financial Barriers

One of the most obvious issues is financial inaccessibility. Braille embossers, screen readers like JAWS, and Braille notetakers can cost hundreds of dollars or more, placing them out of reach for the ordinary Pakistani household. Even when available through institutional assistance, these devices frequently incur additional fees for maintenance, software upgrades, and compatible hardware.

Students from economically poor backgrounds are disproportionately affected. For many of them, education is a luxury, and the added demand for specialized equipment throws an unreasonable load on families. Unlike affluent countries that distribute AT devices through governmental or insurance subsidies, Pakistan lacks extensive social programs in this area.

3.3 Technological Obsolescence

Even when AT tools become available, they are typically obsolete or incompatible with current software and systems. Schools frequently get used or donated technology that no longer supports the most recent versions of instructional apps. Students have reported numerous gadget failures, low battery life, and a lack of technical help, all of which reduce the perceived utility and simplicity of use. Without technical maintenance, even the best devices can become useless. Moreover, lack of user training often leads to equipment misuse or neglect. Thus, ownership does not equate to effective use, further perpetuating the digital divide.

3.4 Linguistic and Cultural Incompatibility

Most AT tools are created in English or other Western languages, making them less useful for Urdu-speaking learners. The lack of Urdu-compatible screen readers and Braille systems restricts access to national curriculum content. Software localization, including text-to-speech engines in Urdu and regional dialects, is still in its early stages, limiting the usefulness of otherwise sophisticated capabilities. Furthermore, cultural subtleties are frequently not included in imported software. For example, apps that rely on Western analogies or metaphors may fail to resonate with Pakistani learners, lowering interest and comprehension. Culturally appropriate, regionally designed solutions are critical for maximizing AT's full potential.

3.5 Educator Preparedness and Pedagogical Limitations

One of the most major impediments to AT adoption is a lack of educator training. According to (Kem, 2022), special education instructors in Pakistan have only intermediate competency in the use of AT, while many general education teachers have no experience at all. The National Institute for Special Education, which was formed with the goal of training educators and generating resources, is underutilized and underfunded (Khowaja, 2020). Furthermore, teacher training is woefully insufficient. Malik and Zia (2021) discovered that less than 20% of Punjab's special education instructors had obtained formal AT training (Malik & Zia, 2021). This lack of readiness leads to underuse of available tools and strengthens students' reliance patterns. Globally, the deployment of AT in educational institutions has been successful in promoting inclusivity.

3.6 Lack of Professional Development

A significant challenge in Pakistan is the lack of adequately trained educators equipped to use and teach with assistive technologies. The effectiveness of these technologies heavily depends on the teachers' ability to integrate them into their teaching methodologies. Professional development programs and training workshops are imperative for equipping educators with the requisite skills and knowledge. However, such programs are often limited in scope

and reach, necessitating a more systemic approach to teacher training in assistive technologies (Malik & Zia, 2021). This gap in training underscores a broader issue in the educational system, where the professional development of teachers is not always aligned with the evolving needs of students, particularly those with disabilities. The lack of trained educators is not just a logistical challenge but also reflects a deeper issue of value and priority within the educational system. The need for comprehensive and ongoing professional development for teachers is critical in ensuring that assistive technology is effectively integrated into the educational experience of visually impaired students.

Teacher education programs frequently do not contain courses on the use of assistive technology or inclusive pedagogical practices. As a result, even well-intentioned instructors may lack the skills and confidence to use AT effectively in their classrooms. This results in wasted chances to include AT in ways that would empower VI students and promote academic inclusion. Furthermore, continuing professional development (CPD) is rarely available. Where CPD sessions exist, they are typically academic rather than practical, leaving instructors unable to troubleshoot problems or change their teaching techniques. Teachers require hands-on training, continuing mentoring, and incentives to use AT technologies into their classroom education.

3.7 Traditional Teaching Methods

The dependence on traditional lecture-based approaches, blackboards, and printed handouts raises further challenges. VI pupils cannot benefit from visual aids or written assignments unless they are converted to Braille, audio, or big print forms, which is rarely done in a timely fashion. The difficulty is exacerbated in courses like physics and mathematics, where visual representations such as graphs and diagrams are critical. Many professors avoid involving VI children in lab-based learning because of the perceived difficulties of adaption. This exclusion perpetuates educational disparity.

3.8 Isolation in Learning Environments.

VI kids frequently feel alienated in classes that are not specifically geared to meet their requirements. They struggle to participate in discussions in real time, take notes, and understand visual clues such as body language, gestures, or board activity. These issues contribute to a decreased sense of belonging and have a detrimental impact on their academic achievement. The absence of peer cooperation exacerbates this problem. When peers are not sensitive to the requirements of VI students, the latter frequently rely primarily on the instructor, resulting in a less dynamic and engaging learning environment.

3.9 Government Initiatives and Policy Framework

The role of the government in Pakistan is pivotal in shaping the landscape of assistive technology for visually impaired students. Recent policies have shown a growing recognition of the importance of inclusive education. However, the translation of these policies into practice is slow and often hampered by bureaucratic inertia and a lack of coordinated effort. There is a pressing need for more robust and targeted policies that specifically address the provision and implementation of assistive technologies in schools. The development of such policies requires a collaborative approach involving educators, policymakers, and technology experts (Ahmed & Mahmood, 2019). This collaboration is essential to ensure that policies are not only well-intentioned but also practical and effective in addressing the ground realities. The slow pace of policy implementation and the gap between policy and practice raise questions about the commitment of the government and educational institutions to truly inclusive education. The need for a more proactive and responsive policy framework is evident, one that not only acknowledges the importance of assistive technology but also actively works towards making it a reality in classrooms across Pakistan. Despite multiple legislative commitments, Pakistan has made little headway in establishing accessible education and encouraging the use of assistive technologies. Since the 18th Constitutional Amendment, the federal government has transferred the responsibility of special education from the federal government to the provinces and currently the federal Directorate General of Special Education runs one National Special Education Centre for Visually Handicapped Children in Islamabad (Ministry of Human Rights, n.d.). Even where provincial systems have expanded overall special-education capacity, VI-dedicated institutions remain concentrated in major cities, leaving rural populations underserved.

3.10 Lack of Accountability

According to this model, the United Nations Convention for the Rights of Persons with Disabilities (UNCRPD, 2006) constitutes one of the major cornerstones, which informs the design and implementation of programs and services to these underserved communities. Within this frame, the notion of equity becomes important. Pakistan ratified UNCRPD in 2011, but no significant programs, services programs, services, or follow up policy reforms, have been adopted or implemented since. Thus, while a government commitment has been made to eliminate discrimination, no systematic measures have been taken to make state-funded institutions such as schools and universities/colleges, accountable, on the basis of this commitment. Without mechanisms of accountability, publicly funded institutions may continue to discriminate by limiting access to their program to students with special needs. Along with limited progress in improving the quality of life of persons with disabilities, access to quality education for them, is also limited.

Educational institutions are not held accountable for enacting inclusive policies or making reasonable modifications. There is no regular data collecting or reporting on the use of assistive technology aids in schools and colleges. As a result, institutions are unlikely to prioritize accessibility unless they are externally sponsored.

3.11 Weak Implementation of Existing Policies

The debate over the best ways to integrate and utilize assistive technology in the education of visually impaired students is ongoing. While there is a consensus on the potential benefits of these technologies, the challenges of implementation, cost, and training remain significant hurdles. Moreover, the question of how to ensure equitable access to these technologies is critical. In Pakistan, addressing these issues is not just a matter of improving education for visually impaired students; it is a crucial step towards building a more inclusive and equitable society.

While Pakistan adopted the UNCRPD and enacted the Sindh Right of Children to Free and Compulsory Education Act (2013), implementation has been shallow. Most regulations do not clearly address inclusiveness or give specific instructions for AT integration. Furthermore, there is a lack of cooperation across many ministries (education, IT, and social welfare), resulting in fragmented activities.

3.12 Cultural and Social Stigmas and Social Alienation

In Pakistan, the stigma associated with disability remains a substantial obstacle. Disability is sometimes perceived as a divine punishment or a source of pity, rather as a condition that can be managed with the correct help. These beliefs influence VI students' willingness to utilize AT technologies openly.

Students who use assistive technology may be mocked or perceived as abnormal by their peers, discouraging them from utilizing these technologies in public. This social pressure erodes their confidence and fosters isolation. Bullying or passive neglect in the classroom can have a significant impact on the mental health of VI kids.

3.13 Family Attitudes

Families sometimes have modest expectations for their VI children, valuing caring above schooling. This perspective restricts incentive to invest in assistive technology or pursue additional education. Overprotective behaviors might inhibit youngsters from using technology freely, thus delaying digital literacy.

3.14 Psychological and Cognitive Challenges

The psychological hurdles to AT adoption are often underestimated, yet they are as important. Many VI students have poor self-esteem and concern over their use of AT. There are significant psychological repercussions from restricted access to AT. Students with visual impairments express emotions of inadequacy, dependence, and loneliness. When students need frequent help with work that they might normally do on their own with AT, these psychological costs are exacerbated. Internalized oppression is also fostered by social stigma. In particular, female students experience double marginalization as a result of prevalent gender prejudices and disabilities. VI women have poorer academic outcomes, greater dropout rates, and fewer job opportunities as a result of this intersectionality

3.15 Fear of Technology

Students unfamiliar with digital tools may be frightened by sophisticated AT gadgets. Without adequate orientation and training, individuals regard these instruments as a burden rather than assistance. Initial failures or problems might instill dread of judgement, leading to avoidance.

4. Recommendations

4.1 Government-Level Interventions

- Increase budget allocation for special education and assistive technology procurement.
- Develop and implement a nationwide inclusive education policy that requires AT integration.
- Collaborate with international organizations to localize and subsidize AT tools.
- Establish procedures for monitoring and evaluating policy implementation to guarantee accountability.

4.2 Institutional Measures

- Establish accessibility audit guidelines for schools and universities.
- Require teacher training on AT and inclusive pedagogy.
- Establish on-campus accessibility resource centers.
- Promote interdepartmental collaboration to foster inclusive settings.

4.3 Community Engagement

Develop awareness campaigns to promote inclusive behaviors and reduce stigma surrounding disability.

- Develop community-based initiatives to educate families and guardians on the use of assistive technologies.
- Engage local NGOs and disability rights groups in advocacy and implementation.

5. Conclusion

Integrating assistive technology into the educational journey of visually impaired students in Pakistan presents technological, pedagogical, cultural, and psychological problems. While the instruments for empowerment exist, their full potential is generally untapped owing to systemic neglect, poor training, and social stigma. Addressing these difficulties necessitates a comprehensive, multi-sectoral plan that includes government changes, educational transformation, community participation, and technology innovation. Only then will assistive technology fulfil its potential as a genuine equalizer for VI kids. In Pakistan, resolving these difficulties is more than just enhancing education for visually impaired kids; it is a necessary step towards creating a more inclusive and equal society.

It can be said, the journey towards fully empowering visually impaired students through assistive technology is complex and multifaceted. It involves not only technological innovation but also systemic change, policy development, and societal advocacy. The experiences of visually impaired students in Pakistan can serve as a microcosm of the broader challenges and opportunities that exist in the intersection of disability, technology, and education. By critically examining these aspects and working towards comprehensive solutions, there is potential to create a more inclusive educational landscape that truly empowers visually impaired students.

Declarations

Conflict of interest	The author declares no conflicts of interest.
Funding	This research received no external funding.
Data availability	Data are available from the corresponding author upon reasonable request.
Use of AI tools	No AI-assisted tools were used in the preparation of this manuscript.

Author contributions	Conceptualization, M.A.; methodology, M.A.; software, M.A.; validation, M.A.; writing—original draft preparation, M.A.; writing—review and editing, M.A.
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