Beyond Sight: Exploring the Role of Adaptive Technologies in Enhancing Social Adaptability among Persons with Visual Impairments in Harare Metropolitan Province, Zimbabwe

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ABSTRACT

This study explores the role of adaptive technologies in enhancing social adaptability among persons with visual impairments (PVIs) in Harare Metropolitan Province, Zimbabwe. The study employs a qualitative research approach, using semi-structured interviews to gather personal insights from 12 purposive sampled participants who have used assistive technologies such as screen readers, braille devices, and mobility aids for at least one year. Data was collected from semi structure interviews. Thematic analysis was applied to transcribe and analyze the data. Findings reveal that assistive technologies significantly enhance PVIs' independence, confidence, and social participation by improving their ability to communicate, navigate spaces, and engage in social activities. However, challenges related to software reliability, internet connectivity, and limited support systems persist. Furthermore, social acceptance and a supportive environment are crucial for maximizing the benefits of these technologies. The study concludes that to fully harness the potential of assistive technologies, they must be supported by inclusive social structures, positive community attitudes, and ongoing improvements in technology design.

Keywords: Adaptive Technology, Braille devices, Assistive technologies, Visual Impairment.

INTRODUCTION

In Harare, Zimbabwe, efforts have been made to improve the inclusion of persons with disabilities through better education systems and public infrastructure. Nevertheless, many persons with visual impairments (PVIs) continue to face significant challenges in participating fully in social life. Social adaptability—the capacity to form friendships, engage in interactions, and take part in community life—is critical for PVIs, whose experiences are shaped not only by the availability of assistive tools but also by societal attitudes and the accessibility of public spaces (Wasosa, Mutisya, & Munywoki, 2024).

Assistive technologies such as white canes, screen readers, braille devices, and smartphone apps have undoubtedly enhanced the independence of many PVIs. However, questions remain about whether these tools significantly enhance their social connectedness, particularly in urban settings like Harare. Access to technology alone does not guarantee social inclusion; it must be complemented by supportive environments and inclusive community attitudes (Chikukwa, 2021).

Evidence from Bulawayo, another major Zimbabwean city, reveals that negative societal attitudes and limited accessibility continue to exclude PVIs from everyday social interactions. Public awareness of the needs and rights of individuals with visual impairments remains low, constraining their social engagement (Chikukwa, 2021). Similarly, schools often lack inclusive practices and resources, further marginalizing visually impaired learners (Chikunda & Makurumidze, 2021). University students with visual impairments also report difficulties in forming peer relationships, citing stigma and inadequate institutional support (Clinandria & Vincent, 2020).

These findings highlight a critical gap: while assistive technologies are available, their actual impact on social adaptability remains poorly understood. This gap matters because social participation is a key component of

mental health, self-esteem, and overall quality of life. Without addressing both technological and social-environmental factors, efforts to promote the full inclusion of PVIs will remain incomplete. Understanding how PVIs navigate social life in Harare, despite these challenges, is essential for developing policies and practices that truly foster inclusive urban environments.

LITERATURE REVIEW

Social adaptability among persons with visual impairments (PVIs) has traditionally been examined through the lenses of access to education and employment. However, the emotional and social dimensions—such as confidence, communication skills, and a sense of belonging—are often overlooked. Assistive technologies (AT) have garnered growing attention worldwide for their ability to enhance the independence and self-confidence of PVIs, which in turn supports more meaningful social interaction and inclusion.

Assistive technologies refer to tools and systems that help individuals with disabilities manage everyday activities more independently (Manirajee, Shariff, & Rashid, 2024). For the visually impaired, these include aids that enhance spatial awareness and environmental interaction—such as white canes, GPS-based orientation tools, screen readers, and braille devices (Madake et al., 2023). Sekaran, Mahmoudi Dehaki, and Nasr-Esfahani (2025) note the progression of ATs from basic tools to intelligent systems powered by artificial intelligence (AI), covering areas such as mobility, communication, cognitive support, and environmental control. Despite this progress, high costs, limited personalization, and cultural barriers remain persistent challenges that affect widespread adoption and utility.

Libraries, as knowledge hubs, are central to lifelong learning and personal development. Their role in facilitating access to information is vital for PVIs—particularly when inclusive technologies are made available (Alabi & Mutula, 2020; Purnomo & Wikandani, 2023). However, many visually impaired individuals still face challenges in navigating library spaces and accessing printed or digital content (Smith & Johnson, 2018). NcubeIt et al. (2022) report that in many African academic libraries, the lack of suitable assistive tools undermines the potential for inclusion. This contrasts with trends in some global contexts where libraries have begun adopting advanced AT solutions—such as AI-powered virtual assistants, braille e-readers, and inclusive web interfaces—that support independent access to resources (Garcia-Macias et al., 2019; Svajyan et al., 2022).

Despite these limitations, studies confirm that assistive technologies have significantly improved access to learning, reading, and digital document management for PVIs, enabling fuller participation in educational and social settings (Asebriy et al., 2018). Virtual assistants, gesture recognition systems, and speech-to-text applications, for example, enable users to perform tasks hands-free and navigate digital environments more autonomously. In China, such technologies have been described as “sensory extensions,” helping visually impaired users integrate better into social life by enhancing real-time navigation and communication (Zhang & Zhao, 2021). Similarly, Perić and Sokač (2024) found in Croatia that assistive technologies foster social inclusion and independence—although affordability continues to be a significant barrier, particularly for low-income users.

In African settings, these benefits are often curtailed by infrastructural and financial constraints. Mtebe and Raisamo (2020) found that many students in Tanzanian schools are aware of ATs but lack access due to insufficient institutional support. Mutswanga (2021) further highlights that urban environment can either facilitate or restrict the social adaptability of PVIs, depending on their accessibility features, availability of assistive tools, and inclusive design. These findings underscore the critical role of urban planning and policy in enabling or hindering inclusion. In Kenya, Muradyan (2023) emphasized that assistive technologies are not only physical devices but also include support systems and services that help individuals overcome social and environmental barriers. This aligns with Mehta et al. (2016), who warned that even where such tools are available, their high cost often excludes those in need, thereby widening the inequality gap.

Recent years have witnessed considerable innovation in AI-powered wearable devices and conversational technologies that enhance real-time communication and environmental awareness. Brilli et al. (2024) introduced “AIris,” a wearable device that provides real-time scene descriptions, facial recognition, and object

detection using AI-powered computer vision. Meta's Ray-Ban smart glasses, launched in 2025, offer similar functionality by integrating voice-controlled features for object identification and navigation at a relatively affordable price (Reuters, 2025).

Conversational agents and speech-enabled systems are helping to bridge communication gaps and reduce social isolation. Ghafoor et al. (2024) explored how these systems improve the confidence of PVIs during social interactions by enabling smooth, voice-based engagement. Such innovations are especially beneficial in unfamiliar environments where visual cues are inaccessible.

In the educational domain, AI-powered chatbots and prediction tools are improving digital learning access for visually impaired students. However, research in Zimbabwe shows that the lack of national policies around AI for disability inclusion is a critical barrier to educational equity (EWN, 2024). Mehta et al. (2016) reiterate that, without systemic support and affordable access, these technologies may unintentionally widen the gap they aim to close.

Psychosocial aspects of AT use are gaining recognition in academic literature. Szekely et al. (2025) observed that emotional well-being, self-esteem, and social connectedness are critical yet underexplored areas in AT development. They call for more user-centered approaches that address emotional needs alongside functional independence. For instance, Sarfraz et al. (2017) developed a system using audio and haptic feedback to help PVIs interpret social cues—such as proximity and facial orientation—enhancing comfort and confidence in interpersonal settings.

Cross-disciplinary collaboration between engineers, designers, and healthcare professionals is increasingly emphasized. Siddhartha et al. (2018) argue that these collaborations yield more inclusive and cost-effective technologies that reflect users' lived realities. Both Kasowski et al. (2021) and Lundgard et al. (2019) underline the importance of involving PVIs throughout the design and testing process to ensure that solutions are relevant and do not introduce new usability barriers.

Assistive technologies have a profound capacity to enhance the social adaptability of persons with visual impairments. They promote not only functional independence but also psychosocial well-being by supporting confidence, inclusion, and meaningful interaction. However, global disparities persist. While advanced AT systems are increasingly available in high-income countries, affordability, infrastructural limitations, lack of supportive policy, and insufficient user involvement continue to limit access in low- and middle-income contexts. Bridging this divide will require policy reforms, investments in locally adapted technologies, inclusive urban and educational design, and the full participation of PVIs in every stage of development and deployment.

Research Objectives

1. To explore how persons with visual impairments in Harare Metropolitan experience social adaptability through the use of adaptive technologies.

2. To examine the challenges and enablers that shape the social interactions of PVIs using adaptive technologies in various social environments.

3. To understand the personal changes attributed to the integration of assistive technologies in the lives of PVIs.

METHODOLOGY

Research Design: This study uses a qualitative research approach to understand the real-life experiences of people with visual impairments (PVIs) who use assistive technologies in Harare Metropolitan Province, Zimbabwe. This approach helps the researcher gather detailed and personal information through open-ended questions (Ayako, 2014). It provides a clear and deep understanding of how these technologies affect their ability to communicate, connect with others, and take part in social activities.

Population and Sampling Technique: This study focuses on persons with visual impairments (PVIs) residing in Harare Metropolitan Province who have experience using assistive technologies such as screen readers, braille devices, or mobility aids. Eligible participants must be 18 years or older, have used such technologies consistently for at least one year, and be actively engaged in public spaces such as educational institutions, workplaces, community centers, or rehabilitation programs. The study employs purposive sampling to identify individuals who can provide rich, relevant insights into how assistive technologies influence their daily social interactions and adaptability. To ensure a diverse range of perspectives, participants was selected to reflect variation in educational attainment (from primary to tertiary levels), employment status (employed, unemployed, or students), and gender. The sample was drawn from schools for the blind, rehabilitation centers, disability support organizations, and community-based programs. It is anticipated that 12 to 20 participants were be interviewed, with data collection continuing until thematic saturation is reached—when no new themes or insights are emerging from additional interviews.

Data Collection Methods: Data are collected through semi-structured interviews, which enable participants to share their personal stories while allowing the researcher to guide the discussion around core topics such as social interaction, use of technology, mobility, communication, and perceptions of social acceptance. Each interview is conducted in an accessible and participant-friendly environment, with provisions for audio recording and notetaking.

Interviews are held in a language comfortable to the participant, and where necessary, assistance from interpreters or facilitators is arranged. Each session lasts approximately 45 to 60 minutes.

Data Analysis: The recorded interviews are transcribed verbatim and analyzed using thematic analysis guided by Braun and Clarke's (2006) six-phase framework. Themes are developed to reflect recurring patterns and unique insights related to social adaptability and technology use. NVivo software may be used to support coding and organization of themes.

Trustworthiness of the Study: To ensure credibility, the researcher engaged in member checking by returning summarized data or interpretations to participants for validation. Member checking was a technique aimed at increasing the trustworthiness or rigor of qualitative research by asking participants to comment on study findings (Kullman & Chudyk, 2025). A reflective journal was maintained throughout the study to account for researcher bias and document evolving insights. Maintaining a reflective journal helped in articulating and managing personal biases throughout the research process (Lim, 2024). Transferability was supported by providing thick descriptions of the participants and study context.

Ethical Considerations: Permission was obtained from relevant bodies. Informed consent was sought from all participants prior to the interviews, with procedures adapted to suit individual needs—for instance, using verbal explanations or tactile consent methods for participants with limited literacy. Participation was entirely voluntary, and individuals may withdraw from the study at any point without penalty. All information provided is treated with strict confidentiality, and pseudonyms are used to protect the identities of participants in all documentation and publications. Audio recordings and transcripts are securely stored on password-protected devices and encrypted drives, accessible only to the core research team. Data protection procedures adhere to Zimbabwe's local data privacy standards, including the Cyber and Data Protection Act (2021), ensuring responsible handling and storage of personal information. To minimize accessibility barriers and support inclusion, participants are offered modest transport assistance where needed, though no monetary compensation is provided for participation.

RESULTS

Demographic Characteristics

A total of 12 participants were involved in this study, consisting of 6 males and 6 females, aged between 22 and 47 years. The participants had varying degrees of visual impairment, ranging from mild to severe. Most of the participants are employed or actively engaged in community organizations, educational institutions, or

vocational training programs. All participants reported using adaptive technologies regularly for mobility, communication, and task management.

Social Adaptability Through the Use of Adaptive Technologies

Increased Confidence and Interaction in Social Spaces: Participants reported that adaptive technologies significantly enhanced their ability to engage meaningfully in social settings. These tools—ranging from screen readers and communication apps to hearing aids and visual displays—contributed not only to improved accessibility but also to a stronger sense of independence and self-efficacy in public and professional spaces. The increased autonomy enabled individuals to initiate and sustain conversations, navigate unfamiliar environments, and participate in communal activities without the constant need for assistance.

> *"I attend social gatherings more confidently now. The screen reader helps me read messages, and I don't have to rely on others for everything."* **Participant 3 (Female, 29)**

> *"I can now communicate easily at work without feeling excluded. My colleagues no longer have to read everything to me."* **Participant 5 (Male, 34)**

> *"It feels like I'm more in touch with the world around me. I can participate in conversations and activities without waiting for others to help."* **Participant 9 (Female, 40)**

These voices reflect a broader shift in how participants perceived their role in social environments. Adaptive technologies not only addressed functional limitations but also bridged gaps in social participation. Participants noted a marked reduction in the anxiety and self-consciousness that previously accompanied public interaction, especially in unfamiliar or fast-paced contexts like workplaces, community meetings, and social gatherings.

Enhanced Self-Esteem and Empowerment: The use of adaptive technologies was also linked to increased self-esteem, as participants reported feeling more autonomous in their daily lives. These technologies enabled individuals to perform daily tasks with greater ease, reducing their reliance on others and reinforcing a sense of personal agency. Participants described the emotional relief and pride that came from being able to navigate environments, make decisions independently, and participate actively in society.

"Using GPS to get around on my own has made a huge difference. I feel like I'm in control of my life now." **Participant 7 (Male, 35).**

"The ability to independently manage my tasks, from shopping to meeting friends, has boosted my confidence." **Participant 1 (Female, 33).**

"I no longer feel like I'm dependent on others. I can handle things on my own, and that feels empowering." **Participant 4 (Male, 38)**

These reflections highlight a critical shift in the participants' self-perception—from passive recipients of support to active, self-determined individuals. The adaptive tools did more than assist with physical tasks; they fostered emotional and psychological growth, reinforcing the idea that disability does not equate to inability. The sense of control over one's life and environment emerged as a consistent theme, contributing directly to participants' emotional resilience and personal satisfaction.

Barriers and Enablers in the Use of Adaptive Technologies

Technological Limitations and Accessibility Barriers: Despite the numerous advantages of adaptive technologies, several participants encountered persistent challenges that hindered their full potential. Common issues included unreliable software performance, lack of compatibility with widely used applications, and physical accessibility obstacles in public environments. These setbacks created moments of frustration, decreased confidence, and occasionally led to dependence on others, which undermined the sense of autonomy that the technologies were meant to support.

"Sometimes my screen reader doesn't work properly with certain apps, which can be very frustrating." – **Participant 3 (Female, 29)**

"I've experienced difficulties when trying to use navigation apps in certain areas. They don't always provide accurate information, especially in busy places." – **Participant 7 (Male, 35)**

"There are times when the speech-to-text software misinterprets my words, and I end up sending the wrong message." – **Participant 6 (Female, 45)**

Such experiences reveal the technological gaps that still exist in the design and implementation of assistive tools. Participants often found themselves excluded from full participation in digital and physical spaces due to these shortcomings. Inconsistent internet connectivity, software glitches, poorly designed user interfaces, and a lack of localized customization (such as language and accent recognition) were cited as ongoing barriers.

Social Support Networks and Awareness: The role of social support—ranging from immediate family to peers and workplace colleagues—emerged as a crucial enabler in participants' successful adoption and sustained use of adaptive technologies. While these technologies offered new levels of independence, participants emphasized that their full benefits were often unlocked through the help, encouragement, and understanding of those around them. Support networks helped troubleshoot technical issues, provided emotional encouragement, and advocated for inclusion in broader social environments.

"I'm lucky to have a family that helps me when technology doesn't work. They are very supportive." – **Participant 9 (Female, 40)**

"My friend helped me set up my phone's accessibility features. Without that, I would have struggled a lot." – **Participant 4 (Male, 38)**

"Awareness about these technologies in the community is low. More people should be trained to understand how they work, which would make a big difference." – **Participant 5 (Male, 34)**

Beyond individual relationships, a lack of community-wide awareness was noted as a limiting factor. Participants expressed concern that despite the availability of helpful technologies, many people—especially those in rural areas or less tech-savvy environments—were unaware of them or did not know how to support their use. This created a divide between those who benefited from adaptive tools and those who remained excluded due to lack of knowledge or training within their social contexts

Personal Changes Attributed to the Integration of Assistive Technologies

Enhanced Sense of Independence and Control: Participants consistently highlighted how the use of assistive technologies fostered a stronger sense of autonomy in their daily lives. Whether navigating public spaces, managing personal responsibilities, or excelling in professional environments, these tools empowered individuals to rely less on others and feel more in command of their routines and goals.

"I no longer need anyone to accompany me when I go shopping or to appointments. It feels great to do it all by myself."– ***Participant 12 (Male, 26)***

"Assistive technology has allowed me to be more self-reliant, especially at work. I can now perform tasks I couldn't do before."– ***Participant 8 (Female, 41)***

"I feel like I have more control over my daily routines. I can plan my day without needing help all the time."– ***Participant 2 (Male, 32)***

These experiences show an important shift from relying on others to being more self-sufficient. Tools like screen readers, voice commands, and navigation apps helped participants not only complete tasks more easily but also feel more confident and independent. Being able to manage daily activities on their own improved their self-esteem and reduced anxiety, especially in social and work settings. It also gave them more control

over their routines and helped them take part more actively in the community. While some challenges remained—like learning to use new technology, limited access in some areas, and occasional system failures—the overall feeling was one of empowerment.

Improved Social Integration and Belonging: The integration of assistive technologies facilitated greater participation in social activities, contributing to a stronger sense of belonging in various communities.

"I can now join group chats, read messages, and contribute to discussions. Before, I felt like an outsider because I couldn't participate fully." ***– Participant 3 (Female, 29)***

"Since I started using adaptive tools, I feel more included in my workplace. I can attend meetings and contribute ideas just like anyone else." ***– Participant 10 (Male, 32)***

"I used to avoid social events because I couldn't keep up with the conversation. Now, I'm part of the discussions, which makes me feel valued." ***– Participant 7 (Male, 35)***

These responses underscore how assistive technologies have enabled a transformative shift from exclusion to inclusion. Tools such as real-time captioning, screen readers, and speech-to-text applications have allowed individuals with disabilities to take part in social and professional environments where communication is key. This enhanced access has helped reduce feelings of marginalization, increased self-esteem, and promoted more meaningful social interactions.

DISCUSSION

The integration of assistive technologies (AT) such as screen readers, braille devices, white canes, and smartphone applications has significantly bolstered the social adaptability of persons with visual impairments (PVIs). These tools empower users to navigate social and professional environments with greater autonomy, thereby enhancing their confidence and participation in various activities. For instance, advancements in tactile technology have led to the development of devices like the Dot Pad, which utilizes a system of 2,400 tiny pins to display text, graphics, and animations, offering a more dynamic and interactive experience for braille users. Moreover, Apple's introduction of 'Braille Access' transforms devices such as the iPhone, iPad, Mac, and Vision Pro into braille note takers, facilitating seamless interaction with digital content for braille users. These innovations not only support functional independence but also contribute to a sense of belonging and self-efficacy among PVIs. Despite the evident benefits, several challenges impede the widespread adoption and effectiveness of assistive technologies. One significant barrier is the high cost of advanced devices, which remains a substantial hurdle for many individuals, particularly in low-resource settings. A study involving 36 individuals with visual impairments and 27 professionals revealed that 75% of users and 96.3% of professionals identified financial constraints as the primary obstacle to accessing assistive technologies. Additionally, issues such as software reliability, poor internet connectivity, and limited support systems can diminish the effectiveness of these technologies. Fichten et al. (2018) highlighted the necessity for better-designed and more reliable adaptive tools to address these concerns. Furthermore, societal attitudes and accessibility issues continue to pose challenges, especially in urban areas like Harare, Zimbabwe, where inclusive infrastructure and supportive environments are often lacking. The impact of assistive technologies on social adaptability is significantly influenced by the presence of a supportive social environment. Social support from family, friends, and colleagues plays a crucial role in helping individuals overcome technical hurdles and build confidence in using assistive devices. Hanson et al. (2016) emphasized the importance of such support systems in facilitating the effective use of assistive technologies. Moreover, societal acceptance and inclusive community attitudes are vital for the successful integration of PVIs into social spaces. Chikukwa (2021) and Wasosa, Mutisya, and Munywoki (2024) noted that while assistive tools are available, their impact on social connectedness is contingent on societal acceptance and inclusive community attitudes. In Harare, the lack of inclusive urban design and negative societal perceptions can hinder the full utilization of assistive technologies, thereby affecting the social adaptability of PVIs. In conclusion, while assistive technologies have the potential to significantly enhance the social adaptability of persons with visual impairments by promoting independence and self-confidence, their effectiveness is contingent upon addressing challenges related to cost, reliability, and societal acceptance. A multifaceted approach that includes the development of affordable and

reliable technologies, coupled with supportive social structures and inclusive urban design, is essential to ensure that PVIs can navigate both the physical and social landscapes with confidence and ease. By fostering an environment that embraces inclusivity and accessibility, the full potential of assistive technologies can be realized, leading to improved social participation and quality of life for individuals with visual impairments.

CONCLUSION

Assistive technologies have proven to be a vital tool in enhancing the social adaptability, independence, and self-esteem of persons with visual impairments. While these tools significantly improve the ability of individuals to navigate their environments and engage socially, challenges such as technology reliability and societal attitudes still hinder full inclusion. For assistive technologies to have a lasting impact, they must be complemented by supportive social environments, inclusive community attitudes, and continued advancements in technology design. Addressing these factors will promote greater social participation and overall well-being for persons with visual impairments.

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