Assistive Technologies for Enhancing Information Accessibility among Student with Physical Disabilities in Kenyan Public Universities

Stephen Maina*, Johnson Mulongo Masinde**, James Mwikya Reuben***

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ABSTRACT

Access to information is essential for academic success, yet students with physical disabilities in Kenyan universities face persistent barriers to equitable participation. This study examined the role of assistive technologies in enhancing information accessibility and academic engagement among SWPDs. A qualitative multiple-case study design was adopted across four Kenyan universities, involving semi-structured interviews with SWPDs, disability coordinators, and registrars, complemented by document analysis of institutional policies and accessibility frameworks. The study investigated four key dimensions: availability of ATs, usability and user-friendliness, adequacy of institutional support, and impact on information access and academic participation. Findings revealed uneven distribution of ATs, concentration of resources in libraries, limited usability due to inadequate training and system integration, and inconsistencies in institutional support mechanisms. SWPDs in better-resourced universities reported higher independence, confidence, and participation, while those in resource-constrained institutions experienced partial access and reliance on peers. The study concludes that effective implementation of ATs requires not only provision but also integration with academic systems, user training, and institutional commitment. Recommendations include systematic provision of accessible technologies, staff capacity building, policy development with clear guidelines and monitoring, and active involvement of SWPDs in decision-making. The study has practical implications for improving campus-wide accessibility, theoretical contributions to understanding technology-mediated inclusion, and policy relevance for enhancing equity in higher education.

* University Librarian, Department of Library Services, Kirinyaga University (stevemainar@gmail.com) (Corresponding Author)
** Lecturer, Department of Humanities, University of Embu (jmmasinde@embuni.ac.ke)
*** Senior Lecturer, Department of Computing and Information Technology, Kirinyaga University (jmwikya@kyu.ac.ke)

1. Introduction

Access to information is central to academic success in contemporary university education. In universities, learning, research, communication, and assessment are increasingly mediated through digital platforms, electronic library systems, learning management systems (LMS), and online repositories (Sahito et al., 2024). For students with physical disabilities (SWPDs), equitable participation in these environments depends significantly on the availability and effectiveness of assistive technologies (ATs) (Putri et al., 2025).

Assistive technologies refer to tools, devices, and software designed to enhance functional capabilities and promote independence among persons with disabilities (Restianty et al., 2024). In university settings, these include adaptive hardware such as alternative keyboards and trackballs, voice recognition systems, screen readers, adjustable workstations, accessible digital platforms, and mobility-supportive infrastructure integrated with academic systems (Ahmed et al., 2025). When properly implemented, ATs reduce barriers to information access, enhance autonomy, and foster academic engagement.

Despite global commitments to inclusive education, significant disparities remain in the provision and effective use of assistive technologies in higher education institutions (World Health Organization, 2022). In many developing contexts, including Kenya, universities have made visible improvements in physical accessibility, such as ramps and disability support offices, but less attention has been paid to evaluating whether assistive technologies are sufficient, user-friendly, and fully integrated into academic systems (Khakali, 2021).

Existing research highlights challenges, including outdated technologies, limited training, weak institutional support, and poor integration with digital learning environments (Maina et al., 2026; Welesilassie et al., 2025). However, empirical studies focusing specifically on Kenyan public universities remain limited, particularly those examining the availability, usability, institutional adequacy, and impact of assistive technologies on information accessibility for SWPDs.

This study, therefore, investigates assistive technologies in Kenyan public universities to determine how effectively they enhance information accessibility and academic participation among SWPDs. By adopting a comprehensive and student-centered approach, the study contributes to the discourse on inclusive higher education and sustainable digital accessibility.

1.1 Statement of the Problem

Access to information is fundamental for academic success, yet students with physical disabilities often face significant barriers in university settings. While universities in Kenya have implemented some accessibility measures, such as ramps, disability support offices, and limited adaptive devices, there is inadequate empirical evidence on the availability, usability, and effectiveness of assistive technologies in supporting independent academic engagement. Existing studies suggest that even where assistive tools are present, challenges such as limited training, poor integration with learning systems, maintenance issues, and inconsistent institutional support restrict their effectiveness. This gap limits SWPDs' ability to fully participate in lectures, access digital resources, and engage in assessments and research activities. Consequently, there is a critical need to examine how assistive

technologies are provided, utilized, and supported in Kenyan public universities to identify systemic barriers and inform interventions that promote equitable information access and academic inclusion

2. Literature Review

The existing literature on assistive technologies in higher education is largely characterized by descriptive accounts of available tools and institutional practices, with limited comparative and critical analysis across studies. While many scholars document the presence of assistive technologies, fewer interrogate their effectiveness, distribution, and contextual relevance, particularly within developing country contexts.

Globally, universities provide a range of assistive technologies, including screen readers, speech-to-text software, Braille displays, text magnification tools, alternative input devices, adaptive furniture, and accessible digital repositories (Alaban & Singh, 2024; Singh et al., 2024). These technologies are intended to promote equitable access to academic information for SWPDs. However, comparative evidence suggests significant disparities in the availability, quality, and integration of these tools across institutions.

Studies on academic libraries indicate that although some universities have invested in adaptive equipment and trained personnel, many lack comprehensive, well-maintained, and scalable systems (Munyoro et al., 2023). In African contexts, research consistently highlights that assistive technologies are often limited in number, outdated, or centralized within specific service points, thereby constraining broader accessibility (Chibangwa & Chigwada, 2025; Munzhelele et al., 2025). This concentration reflects a fragmented approach that fails to embed accessibility across the wider academic environment.

Within Kenya, studies on web accessibility and assistive technology use reveal persistent barriers to independent navigation of electronic resources among SWPDs (Maina et al., 2026). Although some universities have introduced accessible computer laboratories and adaptive tools, their implementation remains uneven and inadequately integrated into core academic processes. Notably, assistive technologies are frequently confined to library settings, with minimal extension to lecture delivery, learning management systems, and assessment platforms (Arunkumar, 2025). This institutional compartmentalization limits their overall impact on learning.

The literature therefore underscores the need for a more holistic institutional mapping of assistive technologies, moving beyond isolated service units to encompass the entire academic ecosystem. Despite this need, there is limited comprehensive empirical evidence documenting the types, distribution, and functionality of assistive technologies in Kenyan public universities (Maina et al., 2025). This study addresses this gap by systematically identifying available technologies across academic environments.

Beyond availability, the effectiveness of assistive technologies is strongly influenced by usability factors such as ease of use, system compatibility, intuitive design, and adaptability to diverse user needs (Atata & Odedeyi, 2025; Moon et al., 2019). Technologies that are not user-friendly or poorly integrated into existing systems can create additional barriers rather than facilitating access.

Research on online education for students with visual impairments emphasizes the importance

of universal design principles and accessible instructional materials in enhancing usability (Oyekunle, 2024). When assistive technologies are incompatible with learning platforms or inadequately configured, students experience reduced engagement and increased frustration. Similarly, studies on digital inclusion highlight persistent challenges such as poor website readability, non-responsive interfaces, and limited awareness of accessibility features (Xie et al., 2024). These challenges are often exacerbated by insufficient training among educators and technical staff.

While much of the literature focuses on visual impairments, usability concerns extend to a broader range of SWPDs who rely on alternative input devices, voice recognition systems, and adaptive workstations. There is a notable lack of empirical research grounded in the lived experiences of these users, particularly within real-world university contexts. This study contributes to addressing this gap by examining usability from the perspective of SWPDs in Kenyan public universities.

Institutional support is another critical determinant of the effectiveness and sustainability of assistive technologies. This includes policy frameworks, budgetary allocation, skilled personnel, technical maintenance, and cross-departmental coordination (Desmond et al., 2018; Maina et al., 2025). Without sustained institutional commitment, assistive technologies risk becoming underutilized or obsolete.

Evidence suggests that universities with structured disability support units and integrated accessibility policies achieve more effective implementation outcomes (Griesmeyer-Krentz et al., 2022). In contrast, fragmented and ad hoc approaches—where technologies are introduced without long-term planning, maintenance, or evaluation—tend to yield limited impact (Ogondiek, 2026). In developing country contexts, financial limitations and technical capacity gaps further constrain the provision and sustainability of assistive technologies (Yilma et al., 2023).

In Kenya, although many public universities have established disability support units, there is limited research evaluating their effectiveness in supporting assistive technology acquisition, integration, and maintenance (Wanjiku, 2025). This study therefore examines the adequacy of institutional support mechanisms in promoting accessible information environments.

Ultimately, assistive technologies aim to enhance information accessibility and academic participation. Information accessibility involves the ability to independently locate, process, and utilize academic resources in both physical and digital formats (Kiruki & Mutula, 2021), while academic participation encompasses engagement in learning activities such as lectures, assignments, assessments, and collaboration.

Empirical studies indicate that inadequate technological support restricts students' independence and limits meaningful academic participation (Afonso et al., 2025). Conversely, effective implementation of assistive technologies has been associated with increased autonomy, confidence, and improved academic outcomes (McNicholl, 2023). However, many studies emphasize general inclusion outcomes without explicitly measuring the direct impact of assistive technologies on information accessibility.

There is therefore a clear gap in empirical evidence, particularly within the Kenyan context, linking assistive technology provision to measurable improvements in academic engagement among SWPDs. This study addresses this gap by evaluating how assistive technologies influence independent access to information resources and participation in academic processes.

3. Methodology

This chapter provides a detailed account of the methodological framework that guided the study. It outlines and justifies the research philosophy, design, study sites, target population, sampling procedures, data collection methods, data analysis techniques, strategies for ensuring trustworthiness, and ethical considerations. In response to the need for methodological transparency, the chapter offers explicit descriptions of how participants were selected, how data were generated and managed, and how analytical decisions were made. This level of detail enhances the rigor, credibility, and reproducibility of the study.

3.1 Research Philosophy

The study was underpinned by an interpretivist research philosophy, which assumes that reality is socially constructed and can only be understood through individuals' lived experiences and subjective interpretations (Acharya, 2025). This philosophical orientation was particularly appropriate given that the study sought to explore information accessibility among students with print disabilities (SWPDs), a phenomenon deeply embedded in personal, institutional, and technological contexts.

Interpretivism enabled the researcher to move beyond surface-level observations and engage with the meanings that participants attach to their experiences. Accessibility is not merely a technical issue but also a social and experiential one, shaped by interactions with institutional systems, assistive technologies, and support structures. Consequently, a positivist approach, which emphasizes objectivity and quantification, would have been insufficient to capture the depth and complexity of these experiences. The interpretivist stance therefore provided a suitable epistemological foundation for generating rich, contextualized insights.

3.2 Research Design

A qualitative multiple-case study design was adopted to facilitate an in-depth and context-sensitive exploration of assistive technology practices within higher education institutions. The qualitative approach was justified by the exploratory nature of the study, which aimed to understand "how" and "why" questions related to accessibility rather than to measure variables or test hypotheses.

The multiple-case study design allowed each university to be treated as a distinct case while enabling cross-case comparisons. This approach strengthened the analytical power of the study by revealing both convergences and divergences in accessibility practices across different institutional settings. Furthermore, examining multiple cases enhanced the robustness and transferability of the findings, as patterns identified across diverse contexts are more likely to be applicable beyond the immediate study sites.

3.3 Study Sites

The study was conducted in four universities in Kenya: University of Nairobi, Alupe University, Mt. Kenya University, and Tangaza University. These institutions were purposively selected to ensure variation in key characteristics, including institutional ownership (public versus private), geographical

location, infrastructure capacity, and levels of assistive technology implementation.

This diversity was critical in capturing a comprehensive picture of accessibility practices within the Kenyan higher education sector. Public universities often differ from private institutions in terms of funding structures, policy implementation, and resource availability, while geographical differences may influence access to technological infrastructure. By incorporating institutions with varying profiles, the study was able to generate comparative insights and identify context-specific as well as common challenges and practices.

3.4 Target Population and Sample Size

The target population comprised three categories of participants: students with print disabilities (SWPDs), disability coordinators, and registrars. These groups were deliberately selected because they represent different yet interconnected perspectives on accessibility within universities.

A total of 36 participants were included in the study, consisting of 24 SWPDs (six from each university), eight disability coordinators, and four registrars (one from each university). The larger proportion of student participants was justified by their central role as primary users of assistive technologies and their capacity to provide detailed accounts of lived experiences. Disability coordinators contributed operational insights into the implementation and management of accessibility services, while registrars offered strategic perspectives on institutional policies and resource allocation.

This triangulation of participant categories enhanced the depth and comprehensiveness of the data by integrating experiential, operational, and administrative viewpoints. The sample size was deemed adequate for qualitative inquiry, as it allowed for rich data generation while remaining manageable for in-depth analysis.

3.5 Sampling Procedures

The study employed purposive sampling as the primary strategy to identify participants with relevant knowledge and experience in assistive technology and accessibility. This approach aligns with qualitative research principles, which prioritize information-rich cases over statistical representativeness.

For students with print disabilities, stratified purposive sampling was applied to ensure diversity across key characteristics such as type of disability, gender, and year of study. This stratification minimized the risk of bias and ensured that multiple perspectives were represented, thereby enhancing the credibility of the findings.

Snowball sampling was used to identify disability coordinators due to the variability in institutional roles and titles associated with disability support services. Initial participants facilitated the identification of other relevant staff members actively involved in accessibility initiatives, making this approach particularly suitable in contexts where formal role definitions may be unclear.

For registrars, a census approach was adopted given their limited number and their strategic importance in institutional decision-making. Including one registrar from each university ensured comprehensive coverage of administrative perspectives.

Sampling continued until data saturation was reached, defined as the point at which no new

themes or insights emerged from additional interviews. This ensured that the data collected were sufficiently rich and comprehensive to address the research objectives.

3.6 Data Collection Methods

Data were collected using semi-structured interviews and document analysis, allowing for methodological triangulation and enhancing the validity of the findings.

Semi-structured interviews served as the primary data collection method due to their flexibility and depth. An interview guide was developed based on the study objectives, ensuring consistency across participants while allowing for probing and follow-up questions. This approach enabled participants to articulate their experiences in their own words, thereby generating rich and nuanced data.

The interviews were organized around key thematic areas, including the availability and usability of assistive technologies, institutional support mechanisms, and challenges encountered. Questions were tailored to each participant category to ensure relevance and depth of inquiry. Each interview lasted between 30 and 60 minutes, was conducted with informed consent, and was audio-recorded to ensure accuracy. The recordings were subsequently transcribed verbatim to preserve the integrity of the data.

Document analysis was employed as a complementary method to provide contextual and corroborative evidence. The documents reviewed included institutional disability policies, ICT and accessibility frameworks, and records related to procurement and resource allocation. This method allowed the researcher to examine the alignment between institutional policies and actual practices, thereby strengthening the credibility of the findings through triangulation.

3.7 Data Analysis

The data were analyzed using thematic analysis, a systematic and flexible approach for identifying and interpreting patterns within qualitative data. The process began with familiarization, during which the researcher immersed themselves in the data by reading and re-reading the transcripts.

This was followed by open coding, where meaningful segments of data were identified and labeled. The codes were then organized into categories based on similarities and relationships, which were subsequently developed into broader themes aligned with the research objectives. This iterative process involved constant comparison and refinement to ensure that the themes accurately reflected the data.

Thematic analysis was particularly suitable for this study because it allowed for both inductive and deductive analysis, enabling the identification of both anticipated and emergent themes. Key themes included the availability of assistive technologies, usability and accessibility challenges, institutional support mechanisms, and the impact of assistive technologies on academic participation.

3.8 Trustworthiness of the Study

To ensure the rigor and quality of the study, the criteria of credibility, transferability, dependability, and confirmability were applied.

Credibility was enhanced through triangulation of data sources and methods, as well as member

checking, where participants were invited to review and validate the findings. Transferability was supported by providing rich, detailed descriptions of the research context, enabling readers to determine the applicability of the findings to other settings.

Dependability was ensured through the maintenance of an audit trail documenting all research processes and decisions, thereby allowing for transparency and potential replication. Confirmability was achieved through reflexive journaling, which enabled the researcher to critically examine and mitigate personal biases, ensuring that the findings were grounded in the data.

3.9 Ethical Considerations

Ethical approval for the study was obtained from the National Commission for Science, Technology and Innovation (NACOSTI). All participants were provided with detailed information about the study and gave informed consent prior to participation.

Confidentiality and anonymity were maintained by assigning codes to participants and removing identifying information from all data records. Data were securely stored and accessed only by the researcher. Participants were also informed of their right to withdraw from the study at any stage without any negative consequences.

These ethical safeguards ensured that the study upheld principles of respect, beneficence, and justice, while protecting the rights and well-being of all participants.

4. Data Analysis and Findings

This chapter presents a refined qualitative analysis of findings derived from interviews and document analysis across the four institutions. Using thematic analysis supported by open and axial coding, the study integrates participants' lived experiences with documentary evidence to provide a triangulated understanding of assistive technology access and use. The findings are presented in detailed prose, with verbatim quotes isolated for emphasis, and corroborated with institutional documents such as policies, procurement records, and strategic plans. This triangulation strengthens the credibility of the findings by highlighting areas of convergence and divergence between policy intentions and actual practice.

4.1 Availability of Assistive Technologies

The findings indicate that assistive technologies are present across institutions but are unevenly distributed, spatially concentrated, and insufficient to meet user demand. A consistent pattern emerging from interviews is that access is constrained not only by the number of devices available but also by their location within institutional spaces.

"The equipment is there, but sometimes you have to wait because only a few computers are adapted." (SWPD-UoN)

This reflects a shared experience of scarcity, where availability does not necessarily translate

into accessibility due to limited quantities. The issue is compounded by the centralization of resources within libraries, effectively restricting access during lectures and other academic activities.

"Most assistive tools are in the library. In lecture halls, you manage on your own." (SWPD-MKU)

Document analysis reinforces these findings and provides a broader institutional perspective. All four universities had disability or inclusion policies; however, only two explicitly mentioned assistive technologies. This indicates a policy-level gap in recognising assistive technologies as a core component of inclusion. Procurement records further revealed irregular acquisition cycles, particularly in Alupe and Tangaza, suggesting that access is not systematically planned but instead occurs intermittently based on available funding.

A comparative analysis of institutional provision further illustrates disparities in the availability and integration of assistive technologies across sites, as shown in Table 1 below:

Table 1. Availability of Assistive Technologies Across Sites

Technology	UoN	Alupe	MKU	Tangaza
Adjustable Workstations	High	Low	Moderate	Moderate
Screen Readers	Moderate	Low	Moderate	Low
Speech-to-Text Software	Moderate	Minimal	Moderate	Minimal
Library Accessibility	High	Moderate	High	Moderate
Lecture Hall Integration	Low	Low	Low	Low

The table shows that UoN demonstrates relatively high provision in adjustable workstations and overall library accessibility, while MKU records moderate provision across most categories. In contrast, Alupe and Tangaza consistently exhibit low to minimal availability, particularly in critical technologies such as screen readers and speech-to-text software. Notably, all institutions report low levels of assistive technology integration within lecture halls, highlighting a systemic gap in embedding accessibility within core teaching and learning environments.

Across all sites, library accessibility is comparatively stronger than other areas, confirming a structural bias toward library-based support. This indicates that assistive technologies are largely confined to designated resource centres rather than being mainstreamed into everyday academic spaces.

Staff perspectives align with these findings, framing the issue in terms of institutional constraints and prioritization.

"Specialized software is not common here." (DC-Alupe)

"Funding limits the number of assistive devices." (REG-Tangaza)

These statements are corroborated by documentary evidence showing the absence of detailed implementation frameworks to operationalise inclusion policies. The convergence of interview data,

document analysis, and comparative institutional evidence indicates that assistive technologies are treated as supplementary provisions rather than embedded components of teaching and learning infrastructure.

While UoN and MKU demonstrate relatively stronger provision, all institutions exhibit a structural bias toward library-based accessibility. This underscores limited mainstreaming of assistive technologies into core academic spaces and highlights the need for more strategic, policy-driven, and system-wide integration to ensure equitable access for students with disabilities.

4.2 Usability and User-Friendliness

Usability emerged as a multi-dimensional theme shaped by training, system compatibility, and technical reliability. Participants' experiences suggest that the effectiveness of assistive technologies depends less on their presence and more on the conditions under which they are used.

A key determinant of usability is user training, which many participants identified as insufficient.

"If someone shows you how to use it, it becomes easy." (SWPD-UoN)

This highlights the role of guided learning in transforming technology from a barrier into an enabler. However, the lack of structured training programs limits this potential.

"Students have not been trained enough to maximize the tools." (DC-Alupe)

Document analysis supports this finding, as institutional policies rarely include provisions for continuous user training or capacity building. Training, where it exists, is often informal and inconsistent, leading to uneven user experiences.

Compatibility challenges, particularly with Learning Management Systems, further undermine usability.

"The system doesn't respond well with voice software during exams." (SWPD-MKU)

This reflects a misalignment between assistive technologies and core academic systems, which is not adequately addressed in institutional ICT policies. Document review shows limited integration planning, suggesting that accessibility considerations are not fully incorporated into digital infrastructure design.

Technical reliability also emerged as a critical concern.

"When the system hangs, you lose time." (SWPD-Tangaza)

This issue is reinforced by document analysis indicating limited technical support staff and absence of maintenance schedules in institutional records. The triangulated evidence suggests that usability is not merely a technical attribute but a function of training, system integration, and ongoing support, factors that are currently underdeveloped across institutions.

- 70% (17/24 SWPDs) reported inadequate training
- 62% (15/24) experienced compatibility issues with LMS

- 50% (12/24) reported frequent technical breakdowns

Likert Scale Clarification
A 5-point Likert scale was used to assess usability:
1 = Very Difficult
2 = Difficult
3 = Neutral
4 = Easy
5 = Very Easy

- Average usability rating across institutions: 3.1 (moderate usability)
- UoN: 3.5 | MKU: 3.3 | Tangaza: 2.9 | Alupe: 2.7

Table 2. Usability Analysis

Dimension	Key Issue	Most Affected Site
Training	Lack of user guidance	Alupe, UoN
LMS Compatibility	Poor integration	MKU
Reliability	System breakdowns	Tangaza

Usability is not solely determined by technology presence but by training, system integration, and maintenance, reinforcing the argument that accessibility is socio-technical rather than purely technological.

4.3 Institutional Support Mechanisms

The findings reveal a pronounced gap between policy commitments and actual implementation, driven largely by financial constraints and weak accountability systems. While all institutions have formal inclusion policies, these are often broad and lack operational detail.

"The policy exists, but implementation depends on departments." (DC-UoN)

This indicates decentralization of responsibility, which leads to inconsistent application across faculties. Document analysis confirms that policies do not clearly define roles, responsibilities, or enforcement mechanisms, resulting in fragmented implementation.

Budgetary limitations were consistently identified as a major barrier.

"Accessibility competes with other priorities." (REG-MKU)

"Budget allocation is minimal." (REG-Alupe)

These perspectives are supported by documentary evidence showing that only one institution has a dedicated budget line for assistive technologies. In other cases, funding is embedded within general budgets, making it vulnerable to reallocation.

Another critical gap identified is the absence of monitoring and evaluation systems.

Document analysis shows that none of the institutions have formal frameworks for tracking accessibility outcomes or assessing the effectiveness of assistive technologies. This lack of oversight is reflected in staff perceptions, where implementation is seen as ad hoc rather than systematic.

- All institutions had formal policy statements, but:

Only 1 university had a dedicated assistive technology budget line
None had clear monitoring and evaluation frameworks

- 83% (10/12 staff) acknowledged inadequate funding
- 75% (9/12) reported absence of monitoring systems

Table 3. Institutional Support

Dimension	UoN	Alupe	MKU	Tangaza
Policy Presence	Strong	Moderate	Moderate	Moderate
Budget Allocation	Moderate	Low	Moderate	Low
Technical Staff	Moderate	Low	Moderate	Low
Monitoring Systems	Weak	Weak	Weak	Weak

There is a systemic disconnect between policy commitment and operational implementation, largely driven by financial and administrative constraints.

The triangulated findings suggest that institutional support is characterized by policy presence without structural reinforcement, limiting the sustainability and effectiveness of accessibility initiatives.

4.4 Impact on Information Accessibility and Academic Participation

Despite the structural and operational challenges identified, assistive technologies were found to have a significant positive impact on students' academic experiences. Participants described increased independence, improved confidence, and enhanced participation in academic activities.

"I can access journals without depending on anyone." (SWPD-UoN)

This reflects a shift toward greater autonomy, particularly in accessing digital resources. The ability to independently retrieve information represents a critical outcome of assistive technology use.

"It boosts confidence because you don't feel different." (SWPD-MKU)

This highlights the psychosocial benefits of accessibility, where technology contributes to a sense of inclusion and belonging. These findings are consistent with institutional policy goals, which emphasize equity and participation, although such outcomes are not systematically measured in practice.

However, the impact is not uniform, and significant barriers remain.

"We still rely on peers because systems are not fully adapted." (SWPD-Alupe)

This indicates that while assistive technologies enhance participation, they do not fully eliminate dependency. Document analysis supports this observation, showing limited integration of accessibility measures into all academic processes, particularly in teaching and assessment.

- 79% (19/24 SWPDs) reported increased independence
- 71% (17/24) reported improved academic confidence
- 54% (13/24) still relied on peer assistance

Table 4. Impact Analysis

Indicator	UoN	Alupe	MKU	Tangaza
Independent Access	High	Moderate	High	Moderate
Online Participation	High	Moderate	High	Moderate
Reduced Dependency	Moderate	Low	Moderate	Low
Academic Confidence	High	Moderate	High	Moderate

Assistive technologies significantly enhance autonomy and participation, but partial implementation limits full inclusion, particularly in resource-constrained institutions.

The triangulated evidence suggests that assistive technologies have transformative potential, but their impact is constrained by partial implementation and systemic limitations.

4.5 Cross-Cutting Analysis

Across all institutions, the findings demonstrate strong interdependence between availability, usability, and institutional support. Triangulation reveals that weaknesses in one area reinforce challenges in others. For example, limited funding affects both availability and technical support, which in turn undermines usability.

Institutions with relatively stronger resource bases show better outcomes, as reflected in both participant experiences and documentary evidence. However, even in these contexts, accessibility remains uneven and incomplete.

Overall, the findings indicate that assistive technologies are necessary but not sufficient for full inclusion. Their effectiveness depends on systemic integration, continuous training, and sustained institutional commitment. The absence of these elements results in a model of partial accessibility, where inclusion is experienced inconsistently across spaces and contexts.

4.6 Methodological Reflection

The integration of interview data and document analysis enhanced the depth and credibility of the findings by enabling cross-verification of evidence. Participant narratives provided insight into lived experiences, while institutional documents revealed structural intentions and gaps. Although the study is limited to four institutions, the use of multiple data sources strengthens analytical transferability and provides a robust foundation for understanding accessibility in similar contexts.

5. Discussion

This chapter interprets the study findings in relation to existing literature, drawing on the triangulated evidence from interviews and document analysis. The discussion moves beyond description to explain how and why the observed patterns occur, highlighting the interconnections between availability, usability, institutional support, and academic participation.

5.1 Objective 1: Availability of Assistive Technologies

The study revealed that assistive technologies (ATs) are unevenly distributed across universities, with clear disparities between relatively well-resourced institutions and those with limited funding. While some universities provide a range of tools such as screen readers, speech-to-text software, and adjustable workstations, others rely on minimal adaptations, often confined to basic physical infrastructure. Importantly, the qualitative findings deepen this understanding by showing that availability is not only about presence, but also about accessibility in practice.

Interview data demonstrated that many students experience "conditional access," where technologies exist but are difficult to use due to limited quantities and centralized locations. The concentration of ATs in libraries, as opposed to lecture halls and learning spaces, reflects what can be described as spatialized accessibility—where inclusion is restricted to specific zones rather than embedded across the institution. Document analysis corroborated this pattern, showing that institutional policies tend to emphasize resource centers rather than mainstream teaching environments, while procurement records revealed irregular and inconsistent acquisition cycles.

These findings align with Alaban and Singh (2024), who emphasize that availability is a primary determinant of equitable access in higher education. However, the current study extends this argument by demonstrating that availability must be understood as distributed availability, not mere presence. Similarly, Maina et al. (2026) highlight that assistive technologies are often concentrated in libraries, leaving other academic spaces underserved, an observation strongly supported by both participant narratives and institutional documents in this study.

The disparities observed across institutions further reflect broader structural inequalities in resource allocation. Public universities, benefiting from larger funding pools, tend to provide more comprehensive AT infrastructure, while smaller and private institutions struggle to maintain even basic provisions. This supports Wanjiku (2025), who calls for national-level policy frameworks to standardize minimum accessibility requirements. The findings suggest that without such frameworks, accessibility remains institution-dependent, resulting in unequal educational experiences for students with physical disabilities (SWPDs).

5.2 Objective 2: Usability and User-Friendliness of Assistive Technologies

The study demonstrates that the effectiveness of assistive technologies is significantly shaped by usability factors, including training, system compatibility, and technical reliability. While some participants reported positive experiences, these were typically linked to prior training or institutional support, indicating that usability is not inherent in the technology itself but is socially and institutionally

mediated.

A key insight from the qualitative findings is that usability is highly dependent on user capacity. Students who received guidance found the technologies easier to use, while those without training experienced frustration and underutilization. Document analysis supports this, revealing that most institutions lack structured training programs or formal capacity-building strategies. This reinforces the argument that usability is not just a design issue, but also a pedagogical and institutional responsibility.

Compatibility challenges with Learning Management Systems (LMS) further complicate usability. Students reported difficulties using assistive technologies during assessments and online learning activities, pointing to a disconnect between accessibility tools and core academic platforms. Institutional documents showed limited integration planning, suggesting that accessibility is often treated as an add-on rather than a design principle in digital systems.

These findings are consistent with Atata and Odedeyi (2025), who argue that adaptive user interface design is critical for enabling independent access. However, the present study adds nuance by showing that even well-designed technologies fail without proper integration and support systems. McNicholl, Desmond, and Gallagher (2023) similarly emphasize that AT effectiveness is mediated by user competence and confidence, a pattern clearly reflected in participants' experiences.

In the Kenyan context, Ahmed et al. (2025) stress the importance of aligning technology procurement with usability considerations. The current findings reinforce this by demonstrating that usability challenges—such as system breakdowns and incompatibility—are exacerbated by weak technical support and lack of maintenance frameworks, as evidenced in institutional documents. Thus, effective AT implementation requires a holistic usability ecosystem that includes training, integration, and ongoing technical support.

5.3 Objective 3: Institutional Support Mechanisms

The findings reveal that institutional support mechanisms are characterized by a significant gap between policy and practice. While all universities studied had formal inclusion or disability policies, their implementation was inconsistent, fragmented, and often dependent on individual departments or personnel.

Interview data highlighted that policy enforcement is decentralized, leading to variability in how accessibility measures are applied across faculties. This is supported by document analysis, which shows that policies often lack clear implementation guidelines, defined responsibilities, and accountability structures. As a result, accessibility initiatives tend to be reactive rather than strategic.

Budgetary constraints emerged as a central barrier, with many institutions lacking dedicated funding for assistive technologies. Documentary evidence confirmed that only one institution had a specific budget line for ATs, while others incorporated accessibility into general budgets, making it vulnerable to competing priorities. This aligns with Griesmeyer-Krentz et al. (2022), who identify disability services personnel as key change agents but caution that their effectiveness is limited without adequate institutional support.

Furthermore, the absence of monitoring and evaluation frameworks represents a critical institutional

weakness. Without mechanisms to track progress or assess impact, accessibility efforts remain uncoordinated and difficult to sustain. This finding supports Wanjiku (2025), who emphasizes that equity-focused models must integrate policy, financial investment, and operational systems.

The study therefore suggests that institutional support must move beyond policy declaration to structured implementation, incorporating dedicated funding, technical staffing, and accountability systems. Without these elements, assistive technologies remain underutilized and their potential impact diminished.

5.4 Objective 4: Impact of Assistive Technologies on Academic Participation

The findings confirm that assistive technologies have a significant positive impact on academic participation, particularly in enhancing independence, confidence, and engagement among SWPDs. Students reported increased ability to access academic materials independently, reducing reliance on peers and support staff. This represents a critical shift toward academic autonomy.

However, the study also reveals that this impact is uneven and conditional. While students in better-resourced institutions experienced greater benefits, those in resource-constrained environments continued to face barriers, often relying on peers when technologies were unavailable or unreliable. Document analysis supports this observation, showing limited integration of accessibility measures into teaching, assessment, and digital learning systems.

These findings align with Sahito, Kerio, and Khoso (2024), who highlight the role of digital libraries and e-learning platforms in enhancing educational equity. The present study confirms this, particularly in institutions where assistive technologies are well-maintained and integrated. Similarly, McNicholl et al. (2023) emphasize the psychosocial benefits of AT use, including increased confidence and self-efficacy—outcomes clearly reflected in participant narratives.

Importantly, the study extends existing literature by demonstrating that the impact of ATs is not absolute but relational, depending on the interaction between technology, institutional support, and user capacity. Where these elements align, ATs function as powerful enablers of inclusion; where they do not, their impact is significantly reduced.

Across all objectives, the study demonstrates that availability, usability, institutional support, and impact are deeply interdependent. Triangulated evidence shows that weaknesses in one dimension directly affect the others. For instance, limited funding reduces availability, which in turn restricts usability, while lack of training further diminishes impact.

6. Conclusion

This study examined the availability, usability, and institutional support of assistive technologies for students with physical disabilities in Kenyan universities. The findings demonstrate that while assistive technologies are present across institutions, their distribution, functionality, and effectiveness vary significantly. Accessibility is shaped not only by the presence of technology but by how it is distributed, integrated, and supported within the academic environment.

The study highlights that institutions combining adequate provision with training, technical support, and policy implementation achieve better outcomes in student engagement, independence, and satisfaction. Conversely, where these elements are weak or absent, accessibility remains limited and inconsistent. The findings therefore underscore the need to move from fragmented interventions to systemic inclusion, where assistive technologies are embedded across all academic processes.

6.1 Recommendations

Universities should adopt a system-wide approach to assistive technology provision, ensuring that tools are not only available but equitably distributed across all learning spaces, including lecture halls, laboratories, and digital platforms. Accessibility should be embedded into institutional infrastructure rather than confined to specialized units such as libraries.

There is a need for structured training programs targeting both students and staff. Continuous capacity building will enhance usability, improve confidence, and ensure that assistive technologies are effectively utilized. Disability coordinators, lecturers, and ICT personnel should be trained to provide ongoing technical and academic support.

Institutions should strengthen policy implementation frameworks by allocating dedicated budgets for assistive technologies, establishing clear operational guidelines, and introducing monitoring and evaluation systems to track progress and outcomes. Accountability mechanisms will ensure that accessibility commitments translate into practice.

Regular maintenance and system integration should be prioritized to ensure compatibility between assistive technologies and learning management systems. Investments in technical support staff and infrastructure are essential for sustaining functionality and reliability.

Finally, universities should actively involve SWPDs in decision-making processes, ensuring that assistive technologies and support services are responsive to actual user needs. Participatory approaches will enhance relevance, improve satisfaction, and promote inclusive educational environments.

6.2 Limitations of the Study

Despite the study providing valuable insights into the availability and usability of assistive technologies for students with physical disabilities in Kenyan public universities, several limitations should be acknowledged. The study focused on only four universities, which, while diverse in type and location, may not fully represent the experiences of students across all public and private institutions in Kenya. As such, the findings may have limited generalizability beyond the selected sites. The study relied primarily on qualitative methods, capturing perceptions, experiences, and self-reported challenges. While this approach offered rich, in-depth insights, it did not quantify the broader prevalence or impact of assistive technology usage, limiting the ability to make statistical generalizations.

Some data were dependent on participants' willingness to disclose personal experiences, and factors such as social desirability bias or underreporting of challenges could have influenced responses. Additionally, the study focused on physical disabilities, with less emphasis on the intersectionality of multiple disabilities, which may present unique accessibility challenges. Finally, infrastructural

and resource constraints within the selected universities, such as limited documentation on assistive technology deployment and variations in institutional support, may have affected the completeness of the data collected. Despite these limitations, the study provides a robust foundation for understanding assistive technology accessibility and offers actionable insights for enhancing inclusivity in higher education.

6.3 Implications of the Study

6.3.1 Practical Implications:

The study underscores the need for universities to implement user-centered assistive technologies and ergonomic interventions that enhance information accessibility for students with physical disabilities. Practical measures such as functional assistive devices, accessible library layouts, and well-integrated digital platforms can directly improve students' independence, academic engagement, and overall learning experiences. The findings also highlight the importance of training staff and disability coordinators to support and maintain these interventions effectively.

6.3.2 Theoretical Implications:

The research contributes to the growing body of knowledge on assistive technology and inclusive higher education by providing empirical evidence on the usability and effectiveness of assistive tools in real-world university settings. It supports conceptual frameworks linking technology adoption, accessibility, and user experience, and informs future theoretical models on digital inclusion and equitable information access for students with disabilities.

6.3.3 Policy Implications:

The findings indicate a pressing need for universities and national bodies to develop clear policies and guidelines for implementing assistive technologies, integrating accessibility requirements into infrastructure planning, and ensuring consistent provision of support services. Policy frameworks that mandate inclusive practices and allocate resources strategically can enhance institutional readiness and foster equity in higher education.

6.3.4 Social Implications:

By promoting inclusive educational environments, the study contributes to social equity, reducing barriers that limit participation of students with physical disabilities. Enhanced accessibility and usability of academic resources empower students to engage fully in learning, social interactions, and professional development, thereby strengthening societal inclusion and participation.

Statements and Declarations

Author Contributions: Dr. Stephen Maina conceived the study, conducted data collection and analysis, and prepared the initial draft of the manuscript. Dr. Johnson Masinde provided conceptual and methodological guidance and contributed to manuscript revisions. Dr. James Mwikya offered theoretical insights, validated the findings, and reviewed the manuscript. Dr. Stephen Maina served as the corresponding author and coordinated the submission process. All authors read and approved the final version of the manuscript.
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Institutional Review Board Statement: This study adhered to the ethical standards for academic research as guided by the National Commission for Science, Technology and Innovation. Formal ethical review was not required because the research involved minimal risk and utilized non-invasive data collection methods, including interviews and document analysis, in accordance with institutional research guidelines.
Informed Consent Statement: Informed consent was obtained from all participants involved in the study.
Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author.
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[About the author]

Dr. **Stephen Maina** is a Kenyan scholar in Library and Information Science and currently serves as University Librarian at Kirinyaga University. He holds a PhD in Information and Knowledge Management from Technical University of Kenya, and has successfully completed a second PhD in Information Science at Kirinyaga University, pending formal conferment. He also holds a Master of Library and Information Science from University of Nairobi, a Bachelor of Technology in Information Studies, and a Diploma in Information Studies from Technical University of Kenya. His research interests include digital libraries, knowledge management, information accessibility, disability inclusion, and equitable access to digital resources in higher education. He has made scholarly contributions in accessible digital library services and inclusive information environments.

Johnson Mulongo Masinde is a Lecturer in Information Science at University of Embu. He earned a PhD in Library and Information Science and a Master of Library and Information Science from Central China Normal University, and a Bachelor of Library and Information Science from Kenyatta University. His research interests include knowledge management, research data management, big data analytics, business intelligence, competitive intelligence, digital repositories, and information literacy.

James Mwikya Reuben is a Senior Lecturer in the Department of Computing and Information Technology at Kirinyaga University. He holds a PhD in Management Information Systems from Maseno University, a Master of Science in Computing and Information Systems from Nkumba University, and a Bachelor of Business Information Technology from Nkumba University. His research interests include information systems management, distributed systems, database management, computer security, and ICT-driven innovation in organizations.