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RESEARCH ARTICLE

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A framework for enhancing information accessibility for students with physical disabilities in Kenyan universities through ergonomic interventions

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ABSTRACT

This study investigated how ergonomic interventions can enhance information accessibility for students with physical disabilities in Kenyan universities to develop a comprehensive framework. Using a mixed-methods approach involving surveys and interviews across selected public universities, the study identified significant gaps in inclusive infrastructure, policy implementation, staff preparedness and resource allocation. Findings revealed that while some institutions had initiated ergonomic improvements, most efforts remained fragmented, underfunded or misaligned with the lived experiences of SWPDs. In response, the study proposes a user-centred framework comprising six interlinked pillars: Policy and Governance Integration, Dedicated Resource Allocation, Capacity Building and Awareness, User-Centred Design and Consultation, Continuous Assessment and Feedback Mechanisms, and Inter-stakeholder Collaboration. The framework is designed to foster systematic, sustainable and inclusive ergonomic practices that enhance physical and digital accessibility. The study concludes that adopting this framework can support Kenyan universities in creating more inclusive learning environments where SWPDs can access information equitably.

IMPLICATIONS FOR REHABILITATION

- This study underscores the critical role of rehabilitation in enhancing accessibility for students with physical disabilities (SWPDs) in Kenyan universities through ergonomic interventions. It reveals that while some efforts exist, many universities lack coordinated, adequately funded and inclusive approaches. Rehabilitation professionals are therefore called upon to collaborate with university stakeholders such as planners, IT staff and administrators to implement user-centred ergonomic designs that eliminate both physical and digital barriers. These interventions must be supported by strong policy frameworks, institutional governance and continuous assessments to ensure sustainability and alignment with the evolving needs of SWPDs.
- Additionally, the study highlights the importance of training and capacity building for university staff, ensuring they are equipped to support SWPDs effectively. Rehabilitation efforts must advocate for structured resource allocation and inclusive planning that directly involve students with disabilities in the design and evaluation of interventions. This participatory, multidisciplinary approach positions rehabilitation not just as a medical or therapeutic service, but as a central component in creating equitable, inclusive learning environments within higher education.

PRACTITIONER SUMMARY

This study proposes a six-pillar framework to improve information accessibility for students with physical disabilities in Kenyan universities through ergonomic interventions. It guides practitioners on policy integration, resource allocation, staff training, user-centred design, feedback mechanisms and collaboration to foster inclusive, accessible and sustainable academic environments.

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Introduction

The right to education is enshrined as a human right in global conventions and legal frameworks. However, for many students with physical disabilities (SWPDs), the realisation of this right remains hindered by a range of structural, technological and institutional barriers [1]. The United Nations Convention on the Rights of Persons with Disabilities (UN-CRPD), ratified by over 180 countries, affirms the importance of accessible, inclusive education systems that eliminate discrimination and accommodate the needs of learners with disabilities [2]. The Convention further outlines the necessity of accessible learning environments and information systems, thereby setting a global benchmark for educational inclusivity.

In support of this vision, international agencies such as the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the World Health Organization (WHO) and regional bodies like the African Union continue to promote the rights of SWPDs to equitable access in higher education [3]. Despite this momentum, the practical implementation of such inclusive frameworks remains inconsistent, particularly in developing countries where financial, policy and infrastructural constraints prevail.

In the African context, and within Kenyan universities, efforts to include SWPDs in higher education have been uneven and fraught with challenges. Kenya has demonstrated a formal commitment to disability inclusion through its ratification of the UN-CRPD and the enactment of domestic legislation such as the Persons with Disabilities Act (2003). Nevertheless, actual implementation on the ground often lags, with many universities continuing to operate in ways that inadequately consider the unique accessibility needs of SWPDs [4]. These limitations are most experienced in the area of information accessibility, a cornerstone of academic success.

Access to academic information, whether physical or digital, remains a barrier for many SWPDs in Kenyan universities. A variety of factors contribute to this issue, including inadequate assistive technologies, inaccessible library environments, poorly designed classroom furniture and insufficient staff training on inclusive practices [5]. Additional impediments such as outdated infrastructure, limited budget allocations and fragmented institutional support mechanisms exacerbate the marginalisation of SWPDs. As Yibakuro [6] observes, the lack of legal enforcement and student advocacy has also resulted in universities failing to accommodate the needs of SWPDs in relation to information access.

One key area with potential for addressing these barriers is the use of ergonomic interventions. Ergonomics involves designing environments, tools and systems that align with human capabilities and limitations to optimise comfort, safety and efficiency [7]. In educational settings, ergonomic interventions may include physical modifications such as ramps, adjustable furniture and accessible washrooms, as well as the integration of assistive technologies like screen readers, adaptive keyboards and speech-to-text software. These interventions are valuable for SWPDs, as they can mitigate both physical and digital barriers to participation in academic life [7,8].

While the theoretical value of ergonomic interventions is well understood, their implementation in African universities remains fragmented. For instance, modifications such as ramps or elevators may be installed but fail to meet universal design standards, making them unusable for some SWPDs [9]. Furthermore, design choices prioritise aesthetics or cost over function, and maintenance of accessibility features is overlooked [10]. These shortcomings limit the impact of otherwise well-intentioned initiatives and highlight the need for planning and monitoring.

Assistive technologies represent another promising yet underutilised domain in promoting information access. Tools such as screen readers, Braille displays and voice-recognition systems have been shown to improve access to digital content and learning platforms for SWPDs [11]. However, their availability in Kenyan universities is inconsistent. High acquisition costs, inadequate funding and a lack of trained personnel to support their use curtail their effectiveness [12]. Even when technologies are available, students and staff may lack the awareness or training necessary to utilise them, further undermining their potential [13].

Gaps in institutional policy compound these implementation challenges. Although many universities refer to the principle of inclusivity in their mission statements, few have dedicated frameworks or detailed guidelines for implementing ergonomic interventions [8]. As a result, efforts tend to be sporadic, driven by individual departments or external donors rather than embedded within the university's core strategy. The absence of planning and coordination means that even well-meaning initiatives fail to create lasting

change. As Eneya and Adesina [14] argue, the lack of accountability and monitoring mechanisms weakens institutional responsiveness to SWPDs' needs.

Financial constraints also play a critical role. Implementing ergonomic interventions, particularly the procurement and maintenance of assistive technologies, requires substantial investment. In resource-constrained contexts like Kenya, universities often lack dedicated funding lines for disability-related improvements, leading to reliance on *ad hoc* support or external grants [4].

Furthermore, the lack of awareness among both staff and students about the available resources and legal entitlements of SWPDs contributes to the persistence of access barriers [11]. Faculty members may not receive adequate training on how to accommodate SWPDs, and students themselves may not be informed about the supports and tools available to them. This knowledge gap limits the effective use of existing resources and underscores the need for capacity-building initiatives across institutions.

While some research has explored inclusive education in Kenya, there is a notable paucity of studies focusing on the role of ergonomic interventions in enhancing information accessibility for SWPDs in university contexts [15]. Few empirical studies have examined how these interventions are implemented, the challenges faced and their impact on students' academic experiences.

This study seeks to address this gap by investigating how ergonomic interventions influence information accessibility for SWPDs in Kenyan universities. Specifically, it explores both physical modifications to infrastructure and the availability and effectiveness of assistive technologies. In doing so, the research aims to generate evidence that can inform the development of a comprehensive, user-centred and sustainable framework for enhancing information accessibility in higher education institutions across Kenya.

Literature review

Ayub [16] examined the challenges faced by students with disabilities in colleges in Pakistan due to the absence of inclusive educational frameworks. The research highlighted several barriers, including inadequate infrastructure, mobility challenges, negative attitudes and limited access to information. Students often struggle to access essential information due to the limited availability of channels and resources. The study also pointed to the neglect of students' fundamental needs, which stemmed mainly from a lack of awareness about disability issues within society. Furthermore, the research identified systemic obstacles, including weaknesses in the legal framework, less robust monitoring mechanisms, and a lack of coordination between relevant ministries, which can hinder the effective implementation of inclusive policies. Ayub's research identifies broad systemic issues but does not propose specific frameworks or strategies for addressing ergonomic accessibility. The research gap lies in a lack of a clear, structured framework for implementing effective ergonomic interventions, which would address physical and digital barriers to information access for SWPDs.

The study by Jabour [17] provides insights into the limitations of current university information systems in supporting students with disabilities. The findings revealed that the processes for managing health and disability data were fragmented and less practical, sometimes lacking in areas such as privacy, timely communication, task automation and provision of appropriate disability resources. To address these aspects, the study proposed a two-part workflow model, one component dedicated to managing health and disability information, and another focused on tracking quality of life and wellness outcomes. Notably, the research highlighted the role of academic advisors in facilitating coordination among stakeholders and providing timely support to students with disabilities. In response to these findings, the study suggested redesigning university information systems to enable more streamlined and inclusive data integration processes. It emphasised the importance of adopting standardised protocols and regulations to help ensure effective implementation and long-term sustainability. However, the study acknowledged that such system reforms would likely require substantial capital investment and institutional commitment. Despite its contributions, a key research gap remains. The study did not explicitly explore ergonomic interventions designed to enhance information accessibility for SWPDs. While it provided a conceptual workflow for managing disability-related data, it did not fully address the practical dimensions of accessibility, such as the physical learning environment, adaptive technologies and user-friendly assistive tools. Thus, Jabour's study does not offer a comprehensive framework that integrates both data management and ergonomic considerations necessary for full information access by SWPDs. This gap

suggests the need for further research, such as the current study, which seeks to propose a practical, user-centred framework for implementing effective ergonomic interventions in universities. This framework would aim to address systemic data integration challenges and also focus on the physical, technological and instructional modifications that can contribute to equitable access to academic information for SWPDs.

The study by Nissenbaum [18] demonstrates the benefits of ergonomic modifications within academic settings. The research focused on occupational therapy students and found that when ergonomic interventions were combined with educational programming, there was a notable reduction in stress and physical pain. Additionally, these modifications appeared to lead to increased motivation and engagement among learners. The study underscored the importance of integrating ergonomic design principles into learning environments and supported the active involvement of occupational therapists in the planning and execution of such interventions. This collaborative approach can help ensure that the physical spaces are not only functional but also conducive to overall student well-being. Based on these findings, the study suggested the incorporation of ergonomic awareness into academic infrastructure planning and called for the inclusion of trained professionals, such as occupational therapists, in decision-making processes related to environmental design. The study emphasised that fostering ergonomic awareness and accessibility in educational spaces is essential for helping prevent musculoskeletal issues and improving both physical and mental health outcomes for students, particularly those in physically demanding academic programs. However, a notable research gap remains. While Nissenbaum's study effectively highlighted the general importance of ergonomic design in improving student health and performance, it did not specifically propose a structured or scalable framework tailored to SWPDs in universities. The interventions discussed were not fully contextualised within the broader goal of enhancing information accessibility or addressing the unique ergonomic barriers that SWPDs face in accessing academic content. Therefore, this gap points to the need for a more targeted and comprehensive framework, such as the one being developed in the current study. The present research aims to propose a practical ergonomic intervention framework that not only promotes well-being but also helps ensure equal access to information for SWPDs in university settings. This would involve integrating inclusive design principles, assistive technologies and institutional support structures to address physical and informational barriers to academic participation systematically.

In a study by Oyedokun [11], it was found that creating long-lasting frameworks for the implementation of assistive technologies and ergonomic tools plays an important role in enhancing accessibility for SWPDs. The study highlights the importance of integrating ergonomic writing tools, such as adjustable desks and specialised keyboards, to improve access to information. Furthermore, visually accessible technologies, such as screen readers, voice recognition software and digital text-to-speech tools, have been shown to help enhance the learning experience for SWPDs by addressing barriers related to reading and writing. In addition, the study suggests the necessity of developing adaptable frameworks that focus on technology and environmental design, such as the layout of classrooms, libraries and digital spaces. These frameworks should be based on the principles of Universal Design for Learning (UDL) to help ensure that students of all abilities, including SWPDs, can effectively engage with academic content. To address the needs of SWPDs, the study advocates for a more coordinated approach, where universities collaborate with technology developers, ergonomic specialists and government agencies to implement comprehensive, sustainable strategies. These strategies should aim to continually assess and refine the accessibility features of learning environments and provide ongoing support and training for staff to use assistive technologies effectively. The research proposes that universities adopt clear, structured guidelines for implementing these interventions across campuses, from the classroom to online platforms. These guidelines should help ensure that information delivery is flexible, accessible and inclusive, thus supporting the academic participation of SWPDs and contributing to their academic success. The study emphasises the need for coordination between various stakeholders, including universities, technology developers and government agencies. However, it does not provide concrete strategies for addressing the practical challenges in implementing these frameworks within Kenyan universities' diverse and often under-resourced environments.

The study by Luvale [4] provides insights into policy-level efforts to enhance information access for persons with disabilities (PWDs). The findings reveal that the university had adopted several

commendable strategies to uphold the rights of PWDs, including measures aimed at equal recognition in academic participation, involvement in student leadership, and institutional appointments. Furthermore, awareness-raising initiatives such as the recognition of Disability Mentoring Day, the formation of disability-focused associations, public lectures and workshops highlighted the university's commitment to inclusion. Despite these advances, the study found notable gaps in the implementation of inclusive services at the university library. Key shortcomings included the absence of specialised online search support for visually impaired users, inadequate furniture for those with physical disabilities, a lack of customised information services or designated spaces for PWDs, and the absence of assistive devices and sign language interpreters. While the existing institutional policies were found to be generally effective in promoting inclusion, these gaps appeared to limit the ability of students with disabilities, especially those with physical or sensory impairments, to independently and equitably access academic information resources. The study recommended a comprehensive policy review to accommodate the specific needs of PWDs better, enhance the usability of university services and facilities, and help ensure human resource practices are inclusive. Additionally, it suggested the establishment of a fully equipped resource centre with appropriate assistive technologies, adaptive furniture and trained personnel to support information accessibility for students with disabilities. While Luvale's research sheds light on policy efforts and identifies service delivery gaps, it does not propose a structured ergonomic intervention framework that integrates physical, technological and service-based solutions for enhancing information accessibility among SWPDs. The absence of such a framework highlights the need for systematic, evidence-based ergonomic interventions that address both environmental and informational barriers in university libraries and digital platforms.

The current study seeks to contribute to closing this gap by proposing a comprehensive framework for implementing effective ergonomic interventions explicitly tailored to the needs of SWPDs. This framework would aim to guide policy enhancements and also help ensure practical infrastructural, technological and organisational adjustments are made to improve equal access to academic information resources across university settings.

Methods

This study employed a mixed-methods design, integrating both quantitative and qualitative approaches. This design was chosen to understand the issue, combining numerical data with personal experiences and insights. The research was conducted in four selected universities in Kenya: The University of Nairobi (UoN), Alupe University (AU) in Busia, Mt. Kenya University (MKU) in Thika, and Tangaza University (TU) in Nairobi. The selection aimed to ensure a broad and representative sample, capturing the diversity of higher education institutions in terms of size, type and geographic location. This approach was intended to provide an understanding of how ergonomic interventions affect information accessibility for SWPDs. Participants were selected using a stratified sampling approach. Data collection involved the use of questionnaires and interviews.

Ethical approval for this study was granted by the National Commission for Science, Technology and Innovation (NACOSTI), which regulates and authorises research across Kenyan institutions, under Reference Number 783239. The study adhered to the Declaration of Helsinki principles for research involving human participants. Appropriate ethical standards were maintained to help ensure respondents' confidentiality, privacy and voluntary participation. All collected data were securely stored, with access restricted to authorised research personnel, and no personal identifiers were included in reports. Informed consent was obtained from all participants. Participants provided their verbal consent after being briefed on the study's purpose and how their data would be used. Anonymity was maintained by ensuring that responses could not be traced back to individuals, and pseudonyms were used in quotations to help prevent identifying details from being revealed. Additionally, participation was entirely voluntary, with no coercion involved.

The methodological rigour of this study was supported by its multisite design, triangulated data sources and systematic coding process, aiming to ensure depth and breadth in capturing the realities of SWPDs in universities concerning their ergonomic support and physical access to information.

Table 1 presents the pseudonym coding used for qualitative interview participants drawn from four universities in Kenya. Each pseudonym identifies Students with Physical Disabilities (S), Disability Coordinators (C) and Registrars (R) while preserving participant confidentiality.

Results

This section presents findings on key elements necessary for implementing effective ergonomic interventions that enhance information accessibility for SWPDs in Kenyan universities. It examines stakeholder perspectives on collaborative efforts, staff training, budgetary allocation, periodic assessment and communication of support services. This section also evaluates respondents' views on the most important success factors, such as funding, advocacy, interdepartmental collaboration and policy backing for promoting inclusive learning environments. Additionally, it captures participants' open-ended suggestions, offering practical insights to inform the development of a responsive and sustainable accessibility framework.

Quantitative findings

Key elements for an effective framework for ergonomic interventions

The findings from Table 2 highlight respondents' perceptions of the most important components in a framework for implementing effective ergonomic interventions for SWPDs in universities. A majority, 30 (28.6%), identified collaboration with disability support organisations as the most essential element. This suggests that external partnerships were seen as important in enhancing institutional capacity and expertise in disability matters. Such collaboration may enable universities to tailor their ergonomic interventions to global best practices, potentially leading to more inclusive learning environments. Additionally, 25 (23.8%) of respondents emphasised the need for comprehensive training of university staff, indicating recognition that the effectiveness of interventions depended considerably on the preparedness and awareness of personnel responsible for implementation.

Meanwhile, 20 (19.0%) participants pointed to the allocation of a sufficient budget for accessible infrastructure as vital. This reflected the belief that financial commitment from university management and relevant authorities was central to achieving ergonomic inclusivity. Furthermore, 17 (16.2%) respondents highlighted the importance of regular assessments of accessibility needs, implying that ongoing evaluation was necessary to adapt interventions to evolving student needs. Lastly, 13 (12.4%) viewed clear

Table 1. Pseudonym assignment for qualitative (interview) participants.

Institution	Pseudonyms for students with physical disabilities (SWPDs)	Pseudonym for disability coordinator	Pseudonym for registrar
University of Nairobi	UoN-S1 to UoN-S10	UoN-C	UoN-R
Alupe University	AU-S1 to AU-S5	AU-C	AU-R
Mt. Kenya University	MKU-S1 to MKU-S8	MKU-C	MKU-R
Tangaza University	TU-S1 to TU-S5	TU-C	TU-R

The assigned pseudonyms for qualitative interview participants in a study involving four Kenyan universities. Each university is listed along with coded pseudonyms for students with physical disabilities, a disability coordinator and a registrar.

Table 2. Key elements that should be included in a framework for implementing effective ergonomic interventions at universities for SWPDs (n = 105).

Key element	Frequency	Percentage (%)
Collaboration with disability support organisations	30	28.60%
Comprehensive training for university staff	25	23.80%
Allocation of a sufficient budget for accessible infrastructure	20	19.00%
Regular assessment of accessibility needs	17	16.20%
Clear communication of available resources and services	13	12.40%
Total	105	100%

The frequency and percentage distribution of key elements identified by respondents as important for a practical ergonomic intervention framework for students with physical disabilities in universities.

communication of available resources and services as a key factor, underlining the value of transparency and awareness-raising within university communities. Collectively, these results suggested that successful ergonomic frameworks required a multi-dimensional approach, balancing collaboration, training, resourcing, assessment and communication, with each contributing uniquely to fostering inclusive education.

Most important factor for ensuring effective ergonomic interventions for SWPDs

Table 3 presents the respondents' views on the most important factor for ensuring effective ergonomic interventions for SWPDs in universities. The majority, 36 (34.3%), identified adequate funding as the most important factor. This finding underscored the centrality of financial resources in the successful implementation of ergonomic solutions. Adequate funding enabled universities to procure assistive technologies, install accessible infrastructure and provide specialised equipment tailored to the needs of SWPDs. Without committed and consistent budgetary support, even well-designed policies might remain unimplemented, limiting the intended impact of inclusive education initiatives.

Building on this, 28 (26.7%) of respondents emphasised the role of awareness and advocacy. While funding provided the means, advocacy created the momentum for action. Awareness campaigns were instrumental in shifting institutional mindsets, reducing stigma and promoting a culture of inclusion. These efforts were considered essential in mobilising both internal and external support for accessibility measures. Moreover, advocacy could influence budgetary decisions, thereby indirectly reinforcing the role of funding as highlighted by the respondents.

In addition, 22 (21.0%) of participants pointed to the importance of collaboration between university departments. This reflected the understanding that ergonomic interventions could not be achieved in isolation. Effective implementation required coordination among academic departments, administrative units, disability support offices and facility managers. Such collaboration helped ensure that interventions were comprehensive, well-integrated and responsive to the actual needs of students. When departments worked in unison, duplication was minimised and resources were optimised, thereby complementing both funding and advocacy efforts.

Finally, 19 (18.1%) of the respondents cited policy support from the government as a key enabler. While internal mechanisms were considered important, supportive external policies provided the legal and regulatory framework needed to sustain institutional commitment. Government policies could mandate accessibility standards, allocate dedicated funding and hold institutions accountable for the inclusion of SWPDs. This external reinforcement helped ensure that ergonomic interventions were not viewed as optional but as an institutional obligation.

Qualitative findings

This section focuses on developing a structured framework for implementing effective ergonomic interventions aimed at improving access to information for SWPDs in Kenyan universities. The study sought to determine the essential components that such a framework should entail, identify the institutional policies and strategies necessary to drive accessibility, assess the roles of key stakeholders in the implementation process, and highlight the main barriers hindering inclusive design in academic environments. Respondents shared detailed perspectives on practical tools, administrative reforms and broader systems needed to help ensure meaningful inclusion in both digital and physical learning contexts.

Table 3. Most important factor for ensuring effective ergonomic interventions for SWPDs (n = 105).

Factor	Frequency	Percentage (%)
Adequate funding	36	34.30%
Awareness and advocacy	28	26.70%
Collaboration between university departments	22	21.00%
Policy support from the government	19	18.10%
Total	105	100%

The frequency and percentage distribution of factors identified by respondents as most important for ensuring effective ergonomic interventions for students with physical disabilities.

Data for this section were collected from a targeted group of 28 students, four disability services coordinators and four registrars representing the UoN, Mount Kenya University, AU and Tangaza University. A thematic analysis approach was used to organise responses into core categories, including: framework components, university-level strategies, stakeholder involvement and implementation challenges. These themes and their respective frequency of references offer insight into the current gaps and potential pathways for promoting equity in higher education for SWPDs. The findings presented here form the basis for a practical, scalable framework that universities and policymakers can apply in designing accessible academic environments.

Theme 1: components of an effective ergonomic framework

The development of a user-centred ergonomic framework emerged as a critical need across all institutions. Respondents emphasised the importance of designing digital and physical platforms that were intuitive and accessible to SWPDs, incorporating universal design principles to cater to varying needs without requiring special adaptations. A user-friendly interface was considered important for enabling independent navigation of academic systems. One student explained that poorly designed platforms could increase dependency and limit equal participation in academic processes.

> I use my phone to access learning materials because the university website is not easy to use with screen readers. (UON-S3, Interview, July 2025)

An encouraging development highlighted by several coordinators and registrars was the growing recognition of universal design principles as a foundational approach to inclusion. Unlike retroactive accommodations that often relied on individual requests, universal design promoted the proactive integration of accessibility features into infrastructure, technology and learning systems from the planning stage. This shift reflected a more sustainable and equitable vision, where environments were designed to meet the needs of all users, including students with disabilities, by default rather than exception. The incorporation of universal design not only improved access but also reduced long-term costs associated with modifying existing systems. Additionally, it signalled a change in institutional mindset, from reactive to anticipatory, which could lead to more consistent and inclusive experiences across departments. A registrar from Mount Kenya University expressed this commitment.

> We are now insisting that any new ICT platform or building design must follow universal design standards. (MKU-R1, Interview, July 2025)

Further, the need for regular accessibility audits emerged as a key recommendation for helping ensure that inclusion efforts were not only implemented but also sustained over time. While many institutions might begin with accessible systems or platforms, their functionality could degrade due to software updates, infrastructural changes or a lack of maintenance. Without ongoing monitoring, initial compliance might give way to less noticeable inaccessibility, potentially leaving students with disabilities increasingly disadvantaged. Regular audits would serve as a feedback mechanism, helping institutions to identify gaps, make timely corrections, and foster a culture of continuous improvement. These evaluations would also aim to enhance transparency and accountability, reinforcing the idea that accessibility was an ongoing obligation, not a one-time achievement. A disability services coordinator at AU emphasised this need.

> No one checks whether the systems are still accessible after deployment. An annual review would be helpful. (ALU-C2, Interview, July 2025)

Training for faculty and administrative staff was another recurrent theme that underscored the gap between policy intentions and practical execution. While inclusive education policies might exist on paper, their success depends on the day-to-day interactions between students and academic personnel. Many students with disabilities reported that lecturers sometimes lacked awareness of accessible teaching practices, such as providing readable slide formats, offering materials in advance, or using assistive technologies. The absence of targeted training contributed to unintentional exclusion and created

barriers that hindered full academic participation. These experiences suggested a need for institutionalised training programs that equipped faculty with the necessary skills and attitudes to support diverse learners. As one student with a physical disability explained:

> Some lecturers do not know how to make slides readable or give us materials in advance. (TAN-S5, Interview, July 2025)

Institutional commitment and support were deemed essential to the sustainability of disability-inclusive initiatives. While policy frameworks and accessibility standards provided a foundation, their practical implementation was largely contingent upon the leadership's prioritisation of disability inclusion. Without clear direction, budget allocation and visible endorsement from senior management, inclusive practices often remained symbolic or fragmented. Stakeholders emphasised that when university leadership actively championed these efforts, it fostered a culture of accountability and long-term planning. Conversely, a lack of institutional will could result in stalled reforms and inconsistent practices. As one registrar noted:

> If university leadership does not prioritize disability, all these frameworks will remain on paper. (UON-R2, Interview, July 2025)

Theme 2: institutional policies and strategic interventions

The presence or absence of disability inclusion policies emerged as an important factor influencing how universities approached accessibility and inclusion. Institutions that had formalised and adopted such policies were more likely to invest in capacity building, provide resources and set clear expectations for compliance. These policies served as a guiding framework for action, offering legitimacy and structure to inclusion efforts. In contrast, universities lacking formal policies often had fragmented or *ad hoc* approaches that relied heavily on individual champions rather than institutional systems. As one coordinator observed:

> Since we launched our disability inclusion policy, we have seen more funding and training for staff. Remarked one coordinator (MKU-C1, Interview, July 2025)

The establishment of disability support offices was regarded as a good practice that appeared to enhance access and equity for students with disabilities. These offices served as centralised hubs for coordinating accommodations, advocating for student needs, and helping ensure compliance with institutional policies. In universities where such offices were functional and adequately resourced, students reported timely support in navigating academic and social barriers. Their presence often indicated a university's institutional commitment to inclusion, as they facilitated communication between students, faculty and administration. As one student explained:

> The office helps me get a sign language interpreter or extra time during exams. (ALU-S2, Interview, July 2025)

Integration of accessibility in procurement and construction was another important area highlighted by participants. Respondents emphasised that inclusive infrastructure should be prioritised from the planning and design stages. However, several noted that even newly constructed buildings sometimes lacked basic accessibility features such as ramps or elevators, reflecting less than optimal adherence to universal design standards. These oversights were seen as indicative of broader systemic aspects and a failure to enforce disability policies effectively.

> Imagine constructing a new block without a ramp in 2024, said one student, that tells you where their priorities are. (TAN-S4, Interview, July 2025)

Regular sensitisation and awareness programs were viewed as essential in transforming institutional culture and promoting empathy towards students with disabilities. Participants emphasised that infrastructure alone was not sufficient; meaningful inclusion required changing perceptions and addressing stereotypes. Ongoing training and dialogue were seen as key strategies to shift mindsets across the university community. As one coordinator noted:

> Disability is not just about the infrastructure, it is a mindset. People need to be educated. (UON-C1, Interview, July 2025)

The allocation of accessibility budgets was seen as a factor that could influence the effective implementation of disability inclusion efforts. Participants highlighted that even with robust policies and awareness, a lack of funding often led many initiatives to become stagnant. Dedicated budget lines were viewed as a sign of institutional seriousness and accountability. Without them, programs sometimes stalled at the planning phase. One registrar shared:

> We have policies but no budget line, so nothing moves. (ALU-R1, Interview, July 2025). This underscored the need for institutional financial commitment to help turn policy into practice.

Theme 3: stakeholder roles and collaborative responsibility

The role of government agencies, including the National Council for Persons with Disabilities (NCPWD) and the Commission for University Education (CUE), emerged as an important pillar in enforcing accessibility standards. Respondents emphasised that without legislative reinforcement and routine inspections, some institutions might continue to disregard inclusion mandates. Strengthening these agencies' regulatory power and helping ensure follow-through on compliance mechanisms were seen as important for systemic change.

> We need NCPWD to come inspect and penalize non-compliant institutions. Urged a registrar (TAN-R1, Interview, July 2025)

University administrative support was also identified as a factor in advancing disability inclusion. Many respondents voiced concern that disability offices were frequently marginalised in institutional decision-making processes. Without representation in strategic planning, the needs of students with disabilities were sometimes overlooked. This exclusion could undermine the potential impact of inclusion policies and hinder the implementation of necessary accommodations.

> Our input is rarely considered during university planning meetings. Said a coordinator (MKU-C2, Interview, July 2025)

Inclusive decision-making emerged as a progressive idea supported by both staff and students. Involving SWPDs in policy and planning committees was seen as a step towards genuine representation. Their lived experiences equipped them with firsthand insights that could inform more effective and relevant interventions. One student advocated:

> We need to be in those committees; no one understands our struggles better than us. (ALU-S3, Interview, July 2025)

Accountability frameworks were proposed as essential mechanisms to help ensure that disability inclusion efforts were consistently implemented and maintained across departments. Without clear systems of responsibility and oversight, efforts risked being undermined by blame-shifting or neglect. One registrar emphasised this concern:

> Without accountability, all departments will keep passing the buck. (TAN-R2, Interview, July 2025)

Theme 4: barriers to effective implementation

Despite the recommendations, barriers, especially financial constraints, continued to hinder progress. Many universities faced limited budgets, and disability support sometimes fell lower on the list of funding priorities. This aspect directly affected the availability of assistive technologies, infrastructure modifications and training programs. As one registrar acknowledged:

> We do our best, but disability support is not a priority in budget meetings. (UON-R1, Interview, July 2025)

Institutional neglect or the low prioritisation of disability issues was another recurring theme that highlighted the disconnection between student needs and administrative responsiveness. Students often voiced frustration over delayed or ignored complaints, suggesting a culture of inaction within university systems. One example was shared by a student who said:

> When we report broken elevators, it takes months to fix. (TAN-S2, Interview, July 2025)

Limited staff capacity and awareness further contributed to the problem, acting as a notable barrier to the effective implementation of disability inclusion measures. Even when policies existed on paper, the lack of adequately trained personnel often led to less effective execution. One coordinator stated:

> Our ICT department does not even know what screen-reader compatibility means. Said a coordinator (ALU-C1, Interview, July 2025)

Outdated infrastructure and ICT systems were also identified as notable barriers by multiple respondents. Many university campuses still relied on older buildings that lacked essential features such as ramps, automatic doors or elevators, making physical access difficult for SWPDs. Additionally, legacy ICT systems often did not fully support assistive technologies. One student shared a common experience:

> Sometimes I cannot even log in to the learning portal because it is not accessible. (MKU-S4, Interview, July 2025)

These findings suggested that a multifaceted approach was required to improve accessibility for SWPDs. Institutions might need to go beyond compliance checklists to foster a culture of inclusion. This could include embedding disability perspectives in decision-making, securing budgets, training staff and conducting regular audits. Policymakers might need to enforce accountability, while NGOs and industry partners could offer support. Overall, sustained institutional commitment was considered important to help ensure that SWPDs were not only accommodated but also empowered to thrive in higher education settings.

Discussion

Methodological reflections

The use of a convergent mixed-methods design in this study enabled a nuanced understanding of ergonomic interventions and information accessibility practices from multiple perspectives. The triangulation of interviews and questionnaires contributed to the credibility and dependability of findings regarding these areas. While the purposive selection of four universities provided valuable insights, the generalisability to all Kenyan public universities should be considered with the characteristics of the sampled institutions in mind. Data saturation was achieved mainly across themes for the qualitative data. The inclusion of diverse stakeholders enhanced the richness of the data, capturing institutional, operational and experiential dimensions of ergonomic support and information access NVivo-supported thematic coding allowed for transparent pattern identification.

Interpreting the findings

The findings suggested an uneven landscape of information accessibility, influenced by inconsistent ergonomic interventions, across Kenyan public universities. The quantitative results indicated that collaboration with disability support organisations, comprehensive staff training, sufficient budget allocation, regular needs assessments and clear communication were considered important elements for a practical framework (Table 2). The qualitative data further supported these points, highlighting the need for user-friendly interfaces and universal design principles. This aligns with the broader literature, where Ayub [16] identified a lack of inclusive frameworks and limited access to information as key challenges in similar contexts, emphasising the need for structured approaches to ergonomic accessibility. The emphasis on universal design principles by a registrar from Mount Kenya University directly resonated

with the call by Oyedokun [11] for adaptable frameworks based on UDL, suggesting a move towards proactive, integrated ergonomic solutions for information access.

The study indicated that policy presence alone may not be sufficient without operational mechanisms for ergonomic implementation and information accessibility. Quantitative results showed that adequate funding was perceived as the most important factor (Table 3), followed by awareness and advocacy, collaboration between university departments, and government policy support. These findings supported the argument that the gap between policy and practice can widen without targeted training and resourcing for accessible infrastructure and ergonomically sound environments. The qualitative insights further revealed that limited availability and less consistent maintenance of ergonomic provisions, coupled with less extensive staff training, appeared to impede information accessibility for SWPDs. This was reflected in a student's comment regarding outdated infrastructure ("Sometimes I cannot even log in to the learning portal because it is not accessible" – MKU-S4, Interview, July 2025) and a coordinator's observation about staff awareness ("Our ICT department does not even know what screen-reader compatibility means" – ALU-C1, Interview, July 2025). These points resonated with Kiruki and Mutula [13], who identified institutional aspects as a barrier in African universities concerning physical access and information availability, underscoring the practical implementation challenges related to ergonomic support.

The qualitative insights also revealed specific areas of concern beyond mere presence. The limited number, uneven distribution and frequent disrepair of accessible furniture suggested that existing ergonomic provisions were often insufficient or unreliable. This appeared to hinder equitable access and sometimes required SWPDs to adapt to less comfortable environments. The limitations of accessible computer stations, often outdated or malfunctioning, seemed to restrict independent access to digital resources, potentially undermining the goals of ergonomic design for digital information. The concentration of accessible study tables primarily in central facilities, with minimal provision elsewhere, suggested a lack of consistency in ergonomic design across the campus, potentially limiting overall effectiveness. Furthermore, the issue of designated seating in lecture halls being occupied by students without disabilities, and the less rigorous enforcement, pointed to a need for more consistent policy implementation and sensitisation regarding ergonomic spaces. This aligns with Luvale's [4] findings regarding gaps in inclusive services and inadequate furniture in university libraries, despite existing policies, highlighting the need for more robust ergonomic provisions.

The uneven application of ergonomic interventions across departments, as noted by students, suggested that universities may not be institutionalising ergonomic design as a standard for all facilities. This could create an inconsistent educational experience. The contrast between comparatively well-equipped libraries and less accessible lecture halls was particularly notable; learning occurs in various settings, and neglecting core academic spaces may compromise inclusive education. The limited availability and less consistent maintenance of assistive technologies across campuses appeared to hamper independent information access, potentially leading to increased dependency and academic delays. The lack of inclusive furniture across many facilities sometimes placed SWPDs in uncomfortable or less accessible situations. Moreover, less consistent maintenance of existing ergonomic tools could diminish initial investments, highlighting a need for more systematic monitoring and budgeting. These findings underscore the research gap identified by Jabour [17], whose study on data management overlooked the practical dimensions of information accessibility, such as the physical learning environment and adaptive technologies, reinforcing the need for a comprehensive ergonomic framework that includes practical considerations.

A notable finding was the limited consultation with SWPDs during facility design or renovation. This lack of user input could lead to less optimal ergonomic accessibility features that might have been avoided with direct engagement. As one student advocated, "We need to be in those committees; no one understands our struggles better than us" (ALU-S3, Interview, July 2025). This point reinforces the need for a user-centred ergonomic framework, as suggested by the current study's aim to address the gap identified by Nissenbaum [18], whose work on ergonomic design did not specifically propose a scalable framework tailored to SWPDs for enhancing information accessibility. Finally, the absence of extensive staff training on accessibility needs suggested that even well-intentioned interventions could be less effective due to a lack of awareness or support from personnel. This was supported by the

qualitative finding that "Some lecturers do not know how to make slides readable or give us materials in advance" (TAN-S5, Interview, July 2025), emphasising the importance of human factors in ergonomic implementation.

Furthermore, the role of government agencies, particularly the NCPWD and the CUE, emerged as an essential pillar in enforcing ergonomic accessibility standards. Respondents emphasised that without legislative reinforcement and routine inspections, some institutions might continue to disregard inclusion mandates. Strengthening these agencies' regulatory power and helping ensure follow-through on compliance mechanisms were seen as essential for systemic change. A registrar's comment highlighted this: "We need NCPWD to come inspect and penalise non-compliant institutions" (TAN-R1, Interview, July 2025). University administrative support was also identified as a factor in advancing disability inclusion. Concerns were voiced that disability offices were frequently marginalised in institutional decision-making processes, potentially leading to the needs of students with disabilities being overlooked in ergonomic planning. A coordinator noted, "Our input is rarely considered during university planning meetings" (MKU-C2, Interview, July 2025). Inclusive decision-making, involving SWPDs in policy and planning committees, was seen as a step towards genuine representation, as their lived experiences could inform more effective ergonomic interventions. Accountability frameworks were also proposed as essential mechanisms to help ensure consistent implementation and maintenance across departments, with one registrar stating, "Without accountability, all departments will keep passing the buck" (TAN-R2, Interview, July 2025), reinforcing the need for a structured framework.

Despite the recommendations, financial constraints continued to hinder progress. Many universities faced limited budgets, and disability support sometimes fell lower on the list of funding priorities, directly affecting the availability of ergonomic assistive technologies, infrastructure modifications and training programs. A registrar acknowledged, "We do our best, but disability support is not a priority in budget meetings" (UON-R1, Interview, July 2025). Institutional neglect or low prioritisation of disability issues was another recurring theme, indicating a disconnection between student needs and administrative responsiveness. Students expressed frustration over delayed or ignored complaints, with one noting, "When we report broken elevators, it takes months to fix" (TAN-S2, Interview, July 2025). These findings suggested that a multifaceted approach was required to improve information accessibility for SWPDs through ergonomic interventions, encompassing not only compliance but also fostering a culture of inclusion through embedded disability perspectives in decision-making, securing dedicated budgets, training staff and conducting regular audits.

The observed less-than-optimal user satisfaction and lack of formalised feedback mechanisms appeared to underscore an oversight in current ergonomic and information accessibility implementation strategies. Effective ergonomic design and information accessibility may require continuous user input, as highlighted by the principles of UDL. Without proactive engagement with SWPDs, ergonomic interventions and information accessibility initiatives might be less aligned with actual needs, potentially leading to underutilisation and dissatisfaction. The disparities among universities based on their history, funding and location also pointed to inequities that might need to be addressed at a national policy level regarding the provision of ergonomic interventions and ensuring information accessibility. Institutions like the UoN, with comparatively better resources, demonstrated more consistent implementation of ergonomic features and information access support, suggesting that financial investment and strategic planning are important for successful ergonomic integration and enhanced information accessibility.

A proposed framework for enhancing information accessibility through ergonomic interventions

Based on the quantitative and qualitative findings, and in response to the identified gaps in existing literature, this study proposes a comprehensive framework for enhancing information accessibility for SWPDs in Kenyan Universities through ergonomic interventions. This framework is designed to be user-centred, multi-dimensional and sustainable, addressing both physical and digital barriers.

The proposed framework comprises the following interconnected pillars:

1. *Policy and Governance Integration*: This pillar emphasises the formal adoption and consistent enforcement of disability inclusion policies at both national, including through NCPWD and CUE, and institutional levels. It calls for the integration of accessibility standards into all university regulations, procurement processes and construction guidelines.
2. *Dedicated Resource Allocation*: Recognising that funding is a primary enabler, this pillar advocates for specific, ring-fenced budgets for ergonomic interventions, including accessible infrastructure such as ramps, elevators, accessible furniture and assistive technologies, including screen readers and adaptive keyboards. This ensures that initiatives are not merely aspirational but financially supported.
3. *Capacity Building and Awareness*: This pillar focuses on comprehensive and ongoing training for all university staff, including faculty, administrative and support personnel, on disability awareness, inclusive teaching practices, and the effective use and maintenance of assistive technologies. It also includes sensitisation programs to foster a culture of empathy and reduce stigma within the university community.
4. *User-Centred Design and Consultation*: Central to the framework is the active involvement of SWPDs in the planning, design, implementation and evaluation of all ergonomic interventions. This ensures that solutions are genuinely responsive to their lived experiences and actual needs, promoting the application of universal design principles from inception.
5. *Continuous Assessment and Feedback Mechanisms*: This pillar emphasises the importance of regular accessibility audits and evaluations of ergonomic interventions. Formalised feedback channels, including direct input from SWPDs, are crucial for identifying gaps, making timely adjustments and ensuring the long-term effectiveness and relevance of accessibility measures.
6. *Inter-stakeholder Collaboration*: This pillar underscores the necessity of strong partnerships between university departments, disability support offices, government agencies, including NCPWD, CUE, non-governmental organisations (NGOs) and technology developers. Collaborative efforts can leverage diverse expertise, optimise resource utilisation and ensure a coordinated approach to accessibility.

This framework aims to provide a structured approach for Kenyan universities to move beyond fragmented efforts towards a more systematic and practical enhancement of information accessibility for SWPDs, fostering truly inclusive learning environments.

Conclusions

This study concluded that while some Kenyan public universities had initiated ergonomic interventions and efforts towards enhancing information accessibility for SWPDs, the implementation was often inconsistent, fragmented and appeared insufficient. Notable disparities were observed across institutions regarding the availability, maintenance and user support for accessible ergonomic infrastructure that impacted information access. The limited presence of comprehensive policy frameworks, sustainable funding for ergonomic improvements, and adequate staff training on supporting physical navigation and use of accessible spaces seemed to hinder the realisation of truly inclusive academic environments where information was readily accessible. For effective ergonomic integration and enhanced information accessibility, universities might need to move beyond isolated efforts and adopt a holistic, user-centred approach, supported by consistent institutional commitment and cross-functional collaboration. The proposed framework aims to guide these efforts towards a more systematic and impactful approach.

Limitations

This study, while providing valuable insights into ergonomic interventions and information accessibility, had certain limitations. The purposive selection of four public universities, while diverse, may not have fully represented the entire spectrum of experiences across all Kenyan public universities regarding these specific provisions. The qualitative nature of some data, from interviews, was subject to participant recall bias concerning their experiences with ergonomics and information access. Furthermore, while the study

identified the presence and observed usability of interventions, a detailed quantitative measure of their impact on the academic performance or overall well-being of SWPDs through improved information accessibility was beyond its scope.

Future studies

Future research could explore the following areas related to ergonomic interventions and information accessibility:

- Longitudinal studies to assess the long-term impact and sustainability of ergonomic interventions on academic outcomes and social integration of SWPDs, specifically tracking improvements in their information access.
- Quantitative impact assessments to measure the correlation between specific ergonomic interventions, such as accessible furniture and ramp designs, and improvements in information access, learning efficiency and student satisfaction.
- Comparative studies examining the effectiveness of different policy models and funding mechanisms for disability inclusion in higher education across various developing countries, specifically focusing on how these models support ergonomic provisions and information accessibility.
- Action research projects focused on co-designing and implementing ergonomic solutions for physical spaces with SWPDs to help ensure user-centred and effective interventions that enhance information access.
- Investigations into the practical understanding of both SWPDs and university staff regarding the optimal use of ergonomically designed spaces for information access, and the development of tailored training programs for physical navigation and interaction.

Author contributions

S. Maina was instrumental in the conception and design of this study and took the lead in drafting the initial manuscript. J.M. Masinde made contributions to the analysis and interpretation of the data and critically revised the paper for important intellectual content. J.M. Reuben also played a significant role in the analysis and interpretation of the data and provided revisions to the manuscript. All authors have read and approved the final version of the manuscript to be published and agree to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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