



# Effectiveness of using Assistive Technology on Academic Performance among Secondary School Students with Hearing Impairment in Kenya

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**Abstract:** Learners with hearing impairment in Kenyan secondary schools continue to face significant academic challenges, largely due to communication barriers and limited access to assistive technology (AT). Despite inclusive education policies and growing global recognition of AT's potential to enhance learning, implementation remains inconsistent and under-resourced, particularly in rural areas. The purpose of this study was to examine the effectiveness of assistive technology in improving academic performance among secondary school students with hearing impairment in Kenya. The study employed a descriptive research design based on secondary data obtained from government reports, academic journals, institutional records, and published studies from 2019 to 2024. Document and content analysis were used to examine trends in AT implementation and its impact on learner performance, retention, and engagement. Findings revealed that learners with access to AT—such as hearing aids, captioned content, (frequency modulation (FM) systems, and speech-to-text applications—demonstrated improved academic outcomes, classroom participation, and confidence. Schools with trained teachers, supportive leadership, and consistent AT maintenance reported better learner performance compared to those without such support. However, disparities in access, lack of technical expertise, and inadequate policy enforcement limited AT effectiveness in many institutions. The study concludes that while assistive technology significantly enhances academic performance among students with hearing impairment, its success depends on sustained investment, teacher training, and inclusive education practices. It is recommended that stakeholders strengthen teacher capacity, enhance infrastructure, integrate AT into curricula, and promote collaboration between schools, communities, and policymakers.

**Keywords:** Assistive technology, hearing impairment, academic performance, inclusive education, secondary schools, Kenya.

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## 1. Introduction

The use of assistive technology (AT) is central to promoting inclusive education, particularly for learners with disabilities, such as those with hearing impairment. Assistive technology refers to any tool or device that

enhances the functional capabilities of individuals with disabilities, enabling them to access, participate in, and benefit from education (WHO, 2021). For students with hearing impairment, these technologies include hearing aids, frequency modulation (FM) systems, speech-to-text applications, real-time captioning, video relay services, cochlear implants, visual alert systems, and educational

software that supports sign language translation or visual learning aids. The effectiveness of these technologies lies in their ability to bridge the communication gap, thereby improving comprehension, participation, and academic achievement.

Globally, the integration of assistive technology in secondary education has been a strategic approach to enhancing the academic performance of students with hearing impairment. In the United States, legislative frameworks such as the Individuals with Disabilities Education Act (IDEA) mandate the provision of appropriate AT to support learning (Smith et al., 2022). Research indicates that AT tools significantly improve access to curriculum content and engagement levels among learners with hearing loss (Walker & McCray, 2020). In France, inclusive education policies have led to the use of advanced captioning systems and sign language interpreters in mainstream schools, improving performance among deaf learners (Dubois & Martin, 2021). Similarly, in Canada, the use of FM systems and cochlear implant technology has resulted in enhanced classroom interaction and academic progress among students with hearing impairment (Lavoie et al., 2020).

In Australia, a strong focus on inclusive education has encouraged investment in digital AT tools for students with special needs. Technologies such as captioned media and visual alerting devices have improved academic outcomes and social inclusion for learners with hearing impairments (Anderson & Glickman, 2022). The UK has seen success in deploying classroom audio distribution systems and interactive whiteboards that accommodate students using British Sign Language (BSL), improving both literacy and numeracy outcomes (Thomas & Russell, 2021). Finland, known for its progressive education system, incorporates AT in a way that emphasizes equality and individualized learning pathways, leading to positive academic results for deaf students (Korhonen et al., 2023). In Croatia, national education reforms have expanded the provision of AT in public schools, with preliminary evaluations showing improvements in the academic self-efficacy of deaf students (Kraljević & Buzić, 2021).

In Asia, countries like India and China have begun integrating AT in inclusive classrooms. In India, where sign language interpretation is limited, mobile-based speech-to-text and captioning tools have shown promise in enhancing understanding and classroom participation among hearing-impaired students (Patel & Verma, 2022). China has implemented large-scale cochlear implant programs and is exploring AI-driven interpretation tools to support deaf learners (Zhang & Liu, 2023). Malaysia's inclusive education policies have introduced visual and auditory technologies in secondary schools, which have

helped students with hearing impairment improve academic outcomes, particularly in reading and comprehension (Yusof et al., 2022). In Brazil, AT use is supported by public policy, with community-based interventions that leverage both technology and peer support to enhance academic achievement among deaf learners (de Souza & Ferreira, 2021).

The Philippines has embraced a blended model that combines low-cost assistive tools with training for educators on how to adapt instruction. This approach has been effective in improving examination scores and class engagement for hearing-impaired students (Reyes et al., 2020). In South Africa, despite resource constraints, targeted initiatives have introduced visual communication tools and sign language education programs, with observed improvements in learner performance in inclusive settings (Mokoena & Dlamini, 2022). In Egypt, the Ministry of Education has piloted projects involving captioned video content and FM systems, which have increased lesson comprehension for secondary school students with hearing impairment (Kamel & Soliman, 2023). In Algeria, assistive technology is in its early stages, but studies show that simple interventions like amplified classroom audio and teacher training are improving learner outcomes (Benmebarek & Haddad, 2021).

In Nigeria, local innovations such as mobile sign language apps and visual aids have helped to enhance academic performance and classroom communication for deaf learners (Chinweuba & Edeh, 2022). In Ethiopia, AT deployment is challenged by infrastructure gaps, but the use of visual aids and community-supported instruction has made modest gains in learner achievement among students with hearing impairment (Tadesse & Alemu, 2021). Rwanda has seen progress through government-backed inclusive education programs, which incorporate AT such as sign language-friendly content and classroom FM systems; these interventions have positively influenced academic performance in secondary schools (Mukamana & Niyonsenga, 2023).

In Kenya, the Ministry of Education has adopted a policy framework to promote inclusive education, including the use of assistive technology for students with special needs. Despite implementation challenges, schools that have integrated hearing aids, captioned content, and sign language interpreters report improvements in academic participation and achievement among students with hearing impairment (Odongo & Oriedo, 2022). However, access to AT remains uneven, and most rural schools lack the infrastructure and trained personnel necessary to fully implement these technologies (Mureithi & Wanjiku, 2023). Recent studies underscore the need for targeted investments, teacher capacity-building, and integration of

locally appropriate AT tools to bridge the learning gap and ensure equity for hearing-impaired students in secondary schools across Kenya (Kiplagat & Otieno, 2024).

## 2. Literature Review

The use of assistive technology (AT) has emerged as a critical factor in enhancing educational access and academic performance for students with hearing impairment. Recent global attention has shifted towards inclusive education practices supported by technological innovations that bridge communication gaps in classrooms (World Health Organization, 2021). Assistive technologies, including hearing aids, frequency modulation (FM) systems, speech-to-text apps, and video captioning tools, aim to enhance communication, comprehension, and participation for hearing-impaired learners. This literature review explores global and regional studies, comparing methodologies, outcomes, and interpretations across diverse educational and cultural setups. Studies across the world highlight that access to AT significantly impacts academic achievement among learners with hearing impairment. For instance, Alasim (2022) found that the use of real-time captioning and visual alert systems improved reading comprehension and participation in mainstream classrooms. The study adopted a quantitative approach with a quasi-experimental design and reported improved test scores and class engagement among learners using AT compared to control groups. The findings underscore the cognitive and social benefits of integrated AT interventions.

In France, research by Delaporte and Millet (2021) explored the effects of captioned video materials and bilingual (French and French Sign Language) instruction on deaf students in secondary schools. A qualitative case study method revealed that students using AT alongside bilingual instruction showed improved literacy outcomes and greater self-confidence. The study also emphasized the importance of culturally contextualized tools that support students' linguistic identities. In Canada, Lavoie et al. (2020) conducted a mixed-methods study on the use of cochlear implants and classroom FM systems among high school students with hearing loss. The study found that students using a combination of AT tools showed a 20% increase in academic performance over one year. The researchers noted that consistent teacher training and parental involvement were crucial factors in the successful integration of these technologies. The United States has been a leader in the development and integration of AT in special education. Walker and McCray (2020) conducted a longitudinal study across five states using structured classroom observations and academic performance records. The study concluded that students with hearing impairment using AT devices demonstrated better

outcomes in reading fluency and comprehension compared to peers without such interventions. The inclusion of policy analysis also revealed that school-level enforcement of the Individuals with Disabilities Education Act (IDEA) was linked to higher AT adoption rates.

In the United Kingdom, Thomas and Russell (2021) used a randomized control trial to test the efficacy of interactive whiteboards and captioning software for deaf learners in mainstream secondary schools. The results indicated that students using these tools performed significantly better in written assignments and reported improved communication with peers and teachers. The study stressed the importance of school-wide AT policies to sustain these gains. In Germany, Schmidt and Klein (2022) applied a phenomenological approach to examine student experiences using speech recognition software in inclusive classrooms. The findings showed enhanced motivation, reduced isolation, and improved exam performance among hearing-impaired students. However, the study highlighted a lack of uniform policy implementation across regions as a barrier to equitable access. Australia has pioneered inclusive education supported by AT. Anderson and Glickman (2022) used a national survey and focus groups involving teachers and students to assess the impact of captioned multimedia and classroom amplification systems. The research found that students' academic performance, particularly in science and mathematics, improved substantially when AT was combined with differentiated instruction strategies.

New Zealand has adopted a holistic inclusive education framework, integrating Māori cultural perspectives into AT development. A study by McIntosh and Rewi (2023) using participatory action research revealed that students with hearing impairment felt empowered when AT tools included sign language support embedded in culturally relevant setups. Academic performance and classroom involvement increased significantly when such tools were applied. In Sweden, inclusive education policies emphasize universal design for learning (UDL). Eriksson and Hammarström (2021) conducted a cross-sectional study in urban schools and found that real-time text-to-speech apps and personal FM systems improved academic scores and reduced dropout rates. The findings supported the integration of AT within a UDL framework to address multiple learning needs. In Rwanda, Mukamana and Niyonsenga (2023) studied secondary schools implementing government-supported inclusive education programs. Using interviews and academic performance records, the researchers found that students with hearing impairment using basic AT such as visual timetables and sign-supported instruction showed higher literacy levels compared to peers without AT access. The findings emphasize affordability and training as key success factors.

In South Africa, a study by Mokoena and Dlamini (2022) using ethnographic methods in Gauteng Province schools revealed that while hearing aids and captioned materials improved academic outcomes, infrastructural challenges and lack of trained teachers limited the reach of AT. The study recommends sustained investment in teacher professional development and locally adaptable AT solutions. In Mozambique, Chitsonzo and Joao (2023) conducted a mixed-methods evaluation of pilot AT programs in Maputo. The findings showed that visual aids, combined with peer-assisted learning strategies, led to a 30% improvement in literacy scores among hearing-impaired learners. However, the study noted that rural schools lacked the resources to sustain these interventions post-pilot. Niger has made limited progress in AT deployment. Abdoulaye and Maiga (2022) used survey data and academic performance comparisons to show that students with access to mobile-based sign language apps performed better in reading comprehension tests. However, there was a lack of government support for scaling such technologies to public schools. In Zambia, research by Chirwa and Banda (2021) employed experimental design to test the impact of amplified audio systems and visual learning resources in four inclusive secondary schools. Results showed significant gains in academic performance, especially in mathematics and English. The study concluded that AT must be supported by policy and monitoring mechanisms. In Zimbabwe, Matanda and Muswere (2023) used a longitudinal approach to analyze academic trends among students using AT over a three-year period. Findings indicated that continued use of AT improved performance but noted high dropout rates in schools without follow-up support and device maintenance. The authors stressed the need for community awareness and engagement.

In Nigeria, a study by Chinweuba and Edeh (2022) used quasi-experimental design to assess the academic performance of hearing-impaired students using mobile AT tools in six public schools. The findings showed improved outcomes in comprehension and class interaction. The study highlighted that local innovation and public-private partnerships can make AT more accessible. In Ethiopia, Tadesse and Alemu (2021) conducted a descriptive study analyzing the role of visual aids and community-based learning strategies. Although AT resources were limited, students in intervention schools performed significantly better in national assessments than those in control schools. The study suggests integrating AT with indigenous support systems. Burkina Faso has limited data on AT use, but a study by Ouedraogo and Sawadogo (2023) analyzed outcomes of a school project using handmade visual aids and audio amplifiers. The qualitative findings showed increased student confidence and better test results, despite limited technical support. The research emphasized grassroots solutions tailored to local realities.

In Cameroon, research by Njoya and Tchana (2022) focused on sign language integration and text-based software. Using classroom observations and test results, the study found that consistent AT use led to improved grammar and comprehension skills. However, lack of government investment hindered scalability of successful pilot interventions.

Senegal's Ministry of Education piloted inclusive schools with AT tools such as mobile apps for sign language. Diop and Sagna (2023) evaluated the outcomes using mixed-methods research and reported improved academic outcomes, particularly in reading and numeracy. The study noted that language localization of AT tools enhanced user engagement. Tanzania's inclusive education policies have facilitated pilot programs using AT. Mwakayusa and Mtey (2022) used case study methodology to assess classroom applications of sign language-friendly video lessons and mobile apps. Academic records revealed better performance in social studies and Kiswahili among students using these tools. However, electricity access and device availability were noted challenges. Uganda has advanced inclusive education through NGOs and donor support. Nansubuga and Okot (2022) conducted a case study in five secondary schools, finding that learners using captioned digital textbooks and FM systems performed better in science subjects. Teachers emphasized that training in AT use was essential for effectiveness.

In Kenya, the integration of assistive technology (AT) in supporting students with hearing impairment remains limited, despite ongoing efforts to promote inclusive education. The Ministry of Education has developed policies aligned with the Special Needs Education Policy Framework (2009) and the Sector Policy for Learners and Trainees with Disabilities (2018), which encourage the use of AT. However, actual implementation in secondary schools, particularly in rural areas, has been inconsistent and underfunded (Odongo & Oriedo, 2022). Many schools lack the necessary infrastructure, such as hearing loops, captioned content, or trained personnel to facilitate the use of these tools, limiting access and potential benefits for learners with hearing impairment. Due to the paucity of localized empirical studies, few have documented the direct impact of AT on academic performance in Kenyan secondary schools. A study by Mureithi and Wanjiku (2023) examined challenges faced by hearing-impaired learners in public secondary schools in Nakuru County. The researchers used interviews and classroom observations and noted that while some students had access to hearing aids, the lack of teacher training in using and maintaining these devices led to limited effectiveness. Students reported difficulties following lessons, especially in large classrooms with poor acoustics. This points to the

importance of not only providing devices but also building the capacity of educators and support staff.

Another related study by Kipkemoi and Mwangi (2021) explored inclusive teaching strategies and their effect on the academic engagement of students with hearing impairment. Though not exclusively focused on AT, the study found that where basic technologies like visual displays, written instructions, and sign language-supported materials were used, students performed better academically. The quasi-experimental study showed improved test scores and class participation compared to settings without these supports. The study recommended further integration of low-cost AT interventions that can be easily adapted to Kenya's diverse educational setups. A more recent study by Wekesa et al. (2023) investigated the availability and utilization of assistive technologies in selected special secondary schools in Nairobi and Kisumu. Using a mixed-methods design, the researchers found that while some institutions had access to digital hearing aids and speech-to-text software, their usage was minimal due to frequent device breakdowns, lack of spare parts, and limited internet access. Teachers expressed the need for ongoing professional development and government support to effectively integrate AT into classroom instruction. The study concluded that although AT had the potential to significantly enhance academic performance, its success depended on systemic support and sustainability measures.

Odongo and Oriedo (2022) carried out a cross-sectional survey among inclusive schools. Their findings revealed that hearing-impaired students using sign language interpretation, captioned videos, and real-time transcription tools achieved higher grades and demonstrated improved engagement. However, resource disparities between urban and rural schools posed implementation barriers. A complementary study in Kenya by Kiplagat and Otieno (2024) used an experimental design and found that students using customized AT applications recorded better performance in English and mathematics. The researchers highlighted that device maintenance and inclusive policy implementation significantly influenced long-term academic success. Comparative studies have shown that students in countries with consistent policy frameworks and teacher training in AT see greater academic improvement. For example, Finland and Sweden outperform Sub-Saharan countries in inclusive education metrics due to systemic support (Eriksson & Hammarström, 2021).

A meta-analysis by Liu et al. (2023) reviewed 50 global studies and concluded that AT improves academic performance by enhancing accessibility, reducing cognitive overload, and increasing motivation among

hearing-impaired students. The analysis emphasized cross-sector collaboration as key to sustainable integration. Given the limited body of studies in Kenya focused specifically on AT and academic performance among secondary school students with hearing impairment, there is a clear gap that this study seeks to address. Existing literature emphasizes the potential of AT when combined with supportive policies, infrastructure, and teacher training. However, the gap in comprehensive and context-specific studies underlines the need for more empirical research, particularly in rural and underserved regions. This study contributes to the growing discourse by examining how assistive technology, when appropriately applied, can reduce educational disparities and improve academic outcomes for learners with hearing impairment in Kenya.

## 2.1 Theoretical Perspective

This study was anchored on the Social Model of Disability as proposed by Michael Oliver in 1983. The theory postulates that disability is not an inherent trait of the individual but rather a consequence of the interaction between people living with impairments and an environment filled with physical, attitudinal, communication, and social barriers. Unlike the medical model, which focuses on the individual's limitations and impairments, the social model emphasizes the need to remove societal obstacles to ensure equal participation and inclusion. It shifts the focus from the person's condition to the structural and systemic factors that hinder their full engagement in society.

In this study, the Social Model of Disability is applied to understand how barriers in the learning environment—particularly the absence or limited use of assistive technologies—negatively affect the academic performance of secondary school students with hearing impairment in Kenya. In framing the problem through this lens, the study advocates systemic change rather than individual adaptation. The integration of assistive technology is seen not merely as a support tool but as a necessary intervention to dismantle educational barriers and foster inclusive learning.

Several scholars have used the Social Model of Disability to examine the role of technology in inclusive education. For instance, Shakespeare and Watson (2001) applied the model to critique institutional practices that exclude learners with disabilities by failing to provide necessary support. Similarly, Beresford (2016) used the model to argue that inclusive practices, including the deployment of assistive technology, must be rooted in an understanding of societal exclusion rather than medical deficits. More recently, Al-Azawei, Serenelli, and Lundqvist (2016)

employed the model in a study on e-learning accessibility, emphasizing how inclusive digital design removes systemic barriers for disabled learners. In the current study, the Social Model of Disability provides a theoretical foundation for analyzing how systemic educational reforms—specifically the provision and effective use of assistive technologies—can improve learning outcomes. It guides the inquiry into institutional readiness, teacher capacity, policy frameworks, and infrastructure as key mediators in the academic success of students with hearing impairment. By doing so, it supports a rights-based approach to education, aligning with global inclusive education policies and Kenya’s commitment to the Sustainable Development Goals (SDG 4).

### 3. Methodology

This study adopted a descriptive research design utilizing secondary data to examine the effectiveness of assistive technology on academic performance among secondary school students with hearing impairment in Kenya. The choice of descriptive design was appropriate for analyzing existing data sources to identify patterns, relationships, and trends without manipulating variables. The study relied entirely on secondary data obtained from credible sources including government reports, national examination results, policy documents from the Ministry of Education, institutional records from special and inclusive schools, published academic journals, and reports by NGOs working with learners with disabilities. Data from the Kenya National Examinations Council (KNEC), the Ministry of Education's Special Needs Directorate, and previous empirical studies provided comprehensive information on learner performance and the availability or use of assistive technologies in Kenyan secondary schools. Data analysis involved document analysis techniques where key variables such as academic performance indicators (e.g., mean scores, transition rates, completion rates) were compared across students with hearing impairment using assistive technology and those without such support. Thematic content analysis was also conducted on qualitative data from prior studies, reports, and policy evaluations to understand the framework of AT implementation, challenges, and outcomes. To ensure credibility, only data sources from the last five years (2019–2024) were included to reflect current trends. Furthermore, triangulation was applied by comparing data across multiple sources to validate findings. The study acknowledged limitations of using secondary data, such as the lack of control over data collection processes and potential data gaps. However, it enabled a cost-effective, broad-based, and ethically unobtrusive approach to evaluating assistive technology's impact at a national level. Ethical considerations were addressed by ensuring proper citation of all secondary sources, maintaining academic

integrity, and using publicly accessible data that did not involve direct interaction with human subjects.

### 4. Results and Discussion

The purpose of this study was to examine the effectiveness of assistive technology (AT) on academic performance among secondary school students with hearing impairment in Kenya. The study aimed to understand how different forms of AT—such as hearing aids, FM systems, captioned content, and speech-to-text tools—have influenced learner engagement, academic outcomes, and classroom participation in various school settings across the country. Data was obtained from published academic journals, government reports, Kenya National Examinations Council (KNEC) databases, policy documents from the Ministry of Education, institutional records from special and integrated secondary schools, and credible reports by NGOs such as Leonard Cheshire and Sense International. This secondary data provided insights into learner performance trends, AT accessibility, and implementation practices.

The findings from the study indicated that schools where AT was actively integrated into the learning environment reported higher academic performance among learners with hearing impairment compared to schools without such tools (Odongo & Oriedo, 2022). Students who accessed captioned educational content, hearing aids, or FM systems were more likely to demonstrate improved literacy and numeracy skills. Further, studies by Wekesa et al. (2023) revealed that institutions in Nairobi and Kisumu that had access to digital hearing aids and transcription software showed better examination results and learner retention rates. This demonstrated a positive relationship between AT access and student academic progression. Furthermore, Mureithi and Wanjiku (2023) found that in Nakuru County, students with hearing impairment who had visual learning aids and simplified instructional materials achieved better grades in English and Kiswahili. The students also exhibited improved self-esteem and class participation. Similarly, Kipkemoi and Mwangi (2021) reported that the integration of basic AT such as written instructions, visual displays, and sign-supported teaching improved learners’ comprehension and engagement. In classrooms where these technologies were consistently applied, performance in assessments showed marked improvement.

Notably, the study discovered that many schools in rural and semi-urban areas lacked the infrastructure or funding necessary to deploy AT tools effectively. As a result, learners with hearing impairment in these settings continued to perform below average (Mureithi & Wanjiku, 2023). However, in schools with teacher training programs

that included AT use, students showed greater improvement in performance and participation. This reinforces the argument that AT alone is insufficient without proper implementation and professional support (Wekesa et al., 2023). Moreover, data from the Ministry of Education indicated that schools supported by development partners or NGOs demonstrated higher AT uptake and better academic outcomes for students with hearing impairments than public schools that relied solely on government funding (Odongo & Oriedo, 2022). Further, the data highlighted that girls with hearing impairment were less likely to access AT due to cultural and gender-based barriers, which impacted their academic outcomes disproportionately. Gender-sensitive AT implementation remains a gap in many Kenyan schools (Kipkemoi & Mwangi, 2021).

Furthermore, analysis of KNEC data from 2020 to 2023 revealed a gradual improvement in national exam performance among students in special schools equipped with AT. The mean score increase was more pronounced in schools using FM systems and interactive whiteboards designed for deaf learners. Similarly, students in integrated schools with captioned content access were able to follow lessons more effectively, which translated to better exam scores in subjects such as English, History, and CRE (Wekesa et al., 2023).

The study also found that real-time transcription tools and mobile-based sign language apps helped bridge the communication gap between teachers and students, especially in inclusive schools with no sign language interpreters (Odongo & Oriedo, 2022). Notably, institutional factors such as administrative support, policy enforcement, and teacher attitudes significantly influenced the effective use of AT in classrooms. Schools with proactive leadership and inclusive policies reported higher success rates. However, despite positive findings in some areas, there remained major inconsistencies in AT provision. A 2022 audit by the Ministry of Education showed that only 28% of public secondary schools with hearing-impaired learners had functional assistive devices (MoE, 2022).

Moreover, many devices supplied by donors or the government were found to be non-functional due to lack of maintenance, poor storage, or absence of trained technicians, making sustainability a critical challenge (Wekesa et al., 2023). Further, regional disparities were evident. Schools in urban centers were more likely to receive AT interventions compared to rural schools, exacerbating inequality in access and academic performance (Mureithi & Wanjiku, 2023). Furthermore, data suggested that where AT was supported by inclusive curriculum design, students performed significantly better

than those using AT in isolation from pedagogical reforms. Integration into teaching methodology was essential for success (Kipkemoi & Mwangi, 2021).

Similarly, studies indicated that parental involvement in AT use contributed to better learning outcomes. Learners whose parents were trained or informed about AT showed higher consistency in device use both at home and school (Odongo & Oriedo, 2022). The findings also showed that peer support systems in inclusive settings enhanced the learning experience. When classmates were trained in basic sign language or encouraged to work in groups with AT users, academic collaboration increased. Notably, the attitude of teachers towards disability and technology played a role in the effectiveness of AT. Teachers who perceived AT as a burden were less likely to integrate it effectively into lessons, negatively affecting learner performance (Mureithi & Wanjiku, 2023).

However, where teachers received regular in-service training on inclusive practices and AT application, the results showed a substantial improvement in teaching quality and learner achievement (Wekesa et al., 2023). Moreover, evidence showed that assistive technologies were more effective when personalized to individual learner needs. Standardized tools often failed to accommodate the varying degrees of hearing loss, limiting their impact. Further, a lack of collaboration between schools and health service providers (e.g., audiologists) was identified as a barrier to effective AT implementation. Learners did not receive timely diagnosis or calibration for hearing aids.

Furthermore, ICT policies in education have yet to fully incorporate assistive technology standards for special needs learners. While digital learning is growing in Kenya, the inclusion of deaf learners remains peripheral (MoE, 2022). Similarly, data from NGOs like Sense International Kenya highlighted the potential of mobile and offline learning platforms tailored to learners with hearing impairment. Pilot projects showed promising results in boosting academic confidence and autonomy. The analysis also revealed that schools with structured monitoring and evaluation systems tracked AT impact more effectively. These schools adjusted strategies based on learner feedback and performance data, improving outcomes over time.

Notably, learners reported feeling more valued and motivated when AT was available. Their increased sense of belonging contributed positively to mental well-being and academic performance (Odongo & Oriedo, 2022). However, persistent challenges such as high student-teacher ratios, lack of sign language interpreters, and policy implementation gaps continued to hinder AT effectiveness

in many parts of the country. Therefore, the findings confirm that assistive technology, when properly implemented, significantly enhances academic performance among secondary school students with hearing impairment in Kenya. However, its success depends on teacher preparedness, device functionality, inclusive policies, and sustained support systems.

## 5. Conclusion and Recommendations

### 5.1 Conclusions

Based on the findings, the study concludes that the use of assistive technology significantly enhances academic performance among secondary school students with hearing impairment in Kenya. Learners who accessed tools such as hearing aids, captioned content, speech-to-text applications, and FM systems showed marked improvements in comprehension, engagement, and examination outcomes compared to those without access. The integration of AT contributed to increased confidence, reduced communication barriers, and better learner participation, particularly in inclusive classroom settings where teachers were trained and supportive. However, the effectiveness of assistive technology was largely dependent on systemic and contextual factors. Unequal distribution of resources, limited teacher preparedness, inadequate maintenance of devices, and regional disparities in infrastructure hindered consistent implementation. While some urban schools demonstrated notable success, many rural institutions lacked the technical capacity and institutional support to fully benefit from assistive technologies. The study therefore underscores the need for a holistic and sustainable approach that combines inclusive policy enforcement, infrastructure investment, and ongoing teacher training to ensure that AT reaches its full potential in transforming the academic experience of learners with hearing impairment.

### 5.2 Recommendations

Based on the findings of the study, the following key recommendations are proposed to enhance the effectiveness of assistive technology in improving academic performance among secondary school students with hearing impairment in Kenya:

1. The Ministry of Education, in collaboration with the Teachers Service Commission (TSC), should provide regular and targeted in-service training for teachers on the use of assistive technologies. Training should focus on device operation, inclusive instructional strategies, and integration

of AT into daily classroom activities to ensure effective utilization.

2. The government and partners should prioritize equitable distribution of assistive technologies across all regions, especially in under-resourced rural schools. Additionally, a structured maintenance and technical support system should be established to ensure that devices remain functional and usable over time.
3. Assistive technology should be embedded into the national inclusive education framework and curriculum guidelines. Schools should be supported to adopt teaching methodologies that incorporate AT use, and monitoring mechanisms should be established to track implementation and learner outcomes.
4. Schools should engage parents, health professionals (e.g., audiologists), NGOs, and community leaders in supporting learners with hearing impairment. Parental awareness programs and partnerships with service providers can improve early diagnosis, consistent AT use, and learner support both at home and school.

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