

Bridging the Inclusion Gap: Factors Influencing Assistive Technology Adoption in Primary Schools

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Abstract:

This study aims to examine the factors influencing assistive technology (AT) adoption and identify the assistive technology devices (ATDs) required to support inclusive learning in primary schools. A qualitative case study design was employed, involving nine teachers from primary schools, purposively selected as informants. Data were collected through interviews and classroom observations and analysed thematically to identify patterns related to learner needs, technology availability, teacher readiness, and institutional conditions. The findings show that AT adoption is primarily needs-driven, with teachers identifying devices according to learners' reading, writing, sensory, motor, and communication barriers. Required ATDs included text-to-speech software, audiobooks, reading pens, FM systems, enlarged-print materials, speech-to-text tools, adaptive writing devices, tablets, educational applications, and augmentative and alternative communication tools. However, adoption was constrained by limited resources, inadequate infrastructure, insufficient AT-specific training, workload pressures, gaps in technical support, and weak institutional support. The study concludes that sustainable AT adoption requires alignment between learner needs, appropriate technologies, teacher competence, and institutional support. The findings imply that primary schools should strengthen funding, continuous professional development, technical assistance, and inclusive technology planning.

Key Words: Assistive Technology, Inclusive Education, Teacher Competence, Educational Accessibility

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INTRODUCTION

Inclusive education is increasingly important because schools are expected to provide equitable opportunities for learners with diverse educational needs (Firdausiyah et al., 2026; Hasbiyallah et al., 2026; Khomairohtusshiyamah et al., 2025; Nurul, 2026). Assistive technology (AT) is central to this goal because it can improve access, participation, independence, academic engagement, and social interaction for learners experiencing barriers to learning (Abdelwahab et al., 2025; McNicholl et al., 2023). Research shows that AT can improve curriculum access and learning outcomes when integrated appropriately into teaching (Lee

et al., 2025). However, these benefits do not automatically emerge from device availability. Effective implementation depends on teacher competence, infrastructure, technical support, pedagogical alignment, leadership, and professional development (Ajani, 2024; Yang et al., 2025). International and South African scholarship shows that these conditions influence technology adoption. Therefore, understanding barriers to AT adoption matters because equitable access to assistive technologies can strengthen inclusive education and prevent technological inequalities from becoming additional educational disadvantages for learners (Kriswanto et al., 2024; Mebratu et al., 2024; Munawaroh & Meedeng, 2024; Murillo-Jiménez et al., 2025; Ogondiek, 2026; Welesilassie et al., 2025).

Despite the potential of assistive technology, many education systems struggle to translate technological availability into inclusive practice (Oyedokun, 2025; Christina & Indra, 2025; Saleh et al., 2025). Teachers and schools may lack the knowledge, training, resources, technical assistance, and institutional support to select and use AT effectively. In South Africa, constraints include unequal access to technology, inadequate teacher preparation, overcrowded classrooms, limited specialised support services, and insufficient leadership support (Ataman et al., 2024; Kosasih et al., 2025; Mundiri & Annisa, 2025; Mathebula et al., 2025; Mogashoa & Nyalunga, 2026). These conditions can make technology integration superficial, sporadic, or disconnected from curriculum delivery and assessment. Evidence also indicates that technologies may reinforce exclusion when implemented without accessibility, training, support, and alignment with inclusive pedagogies (Charles & Alshamsi, 2025; Dhouib et al., 2025). Consequently, the problem is not simply whether AT exists in schools, but whether educators can integrate technologies into inclusive teaching and formative assessment. This problem requires investigation to identify barriers and enabling conditions within primary schools (Kaimara, 2026; Layachi & Pitchford, 2025).

South Africa illustrates these challenges through disparities in access, utilisation, and teacher preparedness. Studies report that some schools possess technological infrastructure, yet differences in availability, functionality, connectivity, and professional development limit classroom integration (Ahiaku et al., 2025; Muyambi & Ramorola, 2025). Educators may receive training focused on operational skills rather than pedagogically grounded technology use, reducing the likelihood that AT becomes embedded in curriculum delivery and assessment (Kohnke et al., 2026; Zhang & Samsudin, 2026). Research also indicates that educators can remain insufficiently knowledgeable about assistive technologies and classroom applications (Ogondiek, 2026). Within inclusive education, these limitations are significant because learners experiencing barriers to learning require differentiated support to participate fully. Nevertheless, evidence concerning AT adoption in primary schools remains somewhat uneven, especially in specific mainstream settings. Tshwane North District therefore represents an important context for examining required AT, adoption barriers,

and conditions shaping integration into inclusive formative assessment (Maguvhe & Mpya, 2025; Matlala et al., 2025).

Previous research establishes important educational value for assistive technology. Reviews and empirical studies indicate that AT can improve accessibility, academic performance, independence, self-efficacy, wellbeing, social participation, and inclusion among learners experiencing barriers to learning (Tan & Nam, 2024). Scholars have also conceptualised AT as a socio-technical system in which technologies interact with users, teachers, institutions, policies, and cultural conditions. This perspective demonstrates that successful implementation requires more than technical provision (Abbasnejad et al., 2026; Zhang & Dong, 2024). Evidence shows that teacher training, infrastructure, policy implementation, awareness, and resource allocation remain determinants of effective AT use (Rawal, 2024). However, much established evidence comes from high-income countries or tertiary education. In contrast, evidence from South African primary schools remains limited. Consequently, the literature shows AT's educational potential but offers limited understanding of how adoption barriers operate in mainstream primary-school classroom environments and formative assessment practices (Kyriakou et al., 2026).

The remaining research gap is contextual and empirical. South African studies have examined access to AT, teacher perceptions of inclusion, support services, and technology integration, but few have systematically investigated factors that impede AT adoption in inclusive formative assessment in public primary schools (Hart, 2023; Mathebula et al., 2025). Evidence from higher education, disability units, or broader technology integration cannot fully explain primary-school classrooms, where teachers face different pedagogical demands, resource constraints, learner diversity, and organisational conditions (Odeh & Lach, 2024). Limited attention has also been given to specific districts such as Tshwane North, including the types of AT required, teachers' perceptions of adoption barriers, and opportunities and challenges surrounding classroom integration (Mathebula et al., 2025). Addressing this gap is important because context-specific evidence can inform teacher development, resource allocation, technical support, and school-level strategies. The present study therefore places primary-school teachers' perspectives at the centre of this inquiry.

The state of the art in this study lies in connecting the documented benefits of AT with the conditions that determine whether those benefits can be realised in inclusive formative assessment. Rather than treating technology adoption as device availability, the study examines AT as a socio-technical and pedagogical process involving teachers, learners, resources, support systems, and school environments. Its novelty lies in focusing on mainstream public primary schools in Tshwane North District and integrating three dimensions: the types of AT required for diverse educational needs, teachers' perceptions of factors impeding adoption, and the opportunities and challenges affecting integration. This approach can generate context-specific evidence for strengthening inclusive

education practice. Such evidence matters because identifying barriers can support equitable technology planning, targeted professional development, and sustainable institutional support for learners facing barriers to learning.

Accordingly, the research problem concerns limited understanding of why assistive technology is not adopted and integrated optimally within inclusive formative assessment in primary schools, particularly in Tshwane North District. The study argues that adoption depends on interaction between technology availability, teacher competence, pedagogical fit, infrastructure, technical assistance, leadership, and institutional support. If these conditions are weak, AT may remain underused despite its potential to enhance participation and learning. This argument leads to three priorities: identifying assistive technologies required for diverse educational needs; examining teachers' perceptions of factors that impede adoption; and identifying opportunities and challenges that facilitate or hinder integration into inclusive teaching and learning. By addressing these priorities, the study seeks to move beyond claims about AT benefits toward a grounded understanding of adoption barriers and conditions for inclusive implementation.

RESEARCH METHODS

This study used a qualitative approach with a descriptive qualitative design (Köhler, 2024; Nassaji, 2020) to explore teachers' experiences and perceptions of factors impeding the adoption of assistive technology (AT) in inclusive education. A qualitative descriptive design was selected because it enables researchers to obtain rich and detailed descriptions of participants' experiences in their natural educational contexts without imposing complex theoretical interpretations. This design was appropriate because the study sought to understand how teachers perceive, experience, and describe barriers affecting the adoption and utilization of AT to support learners experiencing barriers to learning. The study was conducted in three public township primary schools in the Tshwane North District of South Africa. The schools were purposively selected because they were involved in inclusive education and served learners with diverse educational needs. The participants consisted of nine Foundation Phase teachers who directly taught learners experiencing barriers to learning. This setting provided an appropriate context for examining AT adoption from the perspectives of teachers directly involved in inclusive classroom practices.

Data were collected through non-participant observations and in-depth interviews (Almusaed et al., 2025; Schoepf & Klimow, 2022) involving nine Foundation Phase teachers. The data focused on teachers' experiences, perceptions, classroom practices, and the factors impeding the adoption and utilization of assistive technology (AT) in inclusive education. Participants were selected because they had direct experience teaching learners experiencing barriers to learning. Data collection was conducted in three selected public township primary schools in the Tshwane North District during the fieldwork

period, following the necessary institutional and school permissions. Non-participant observations were conducted without intervening in classroom activities to document the classroom context and interactions related to AT use. In-depth interviews subsequently enabled teachers to describe their experiences, perceptions, challenges, and considerations regarding AT adoption. The interview questions addressed resource availability, teacher competence, technical support, pedagogical integration, and institutional conditions influencing the effective adoption of AT.

The trustworthiness of the findings was established through credibility, transferability, dependability, and confirmability. Credibility was strengthened through engagement with the research setting, the use of multiple data collection techniques, and comparison of information obtained from different participants. Transferability was supported through detailed descriptions of the participating schools, teachers, and inclusive education context, enabling readers to assess the findings' applicability to similar settings. Dependability was addressed by maintaining a systematic record of the research procedures, including participant selection, data collection, coding, categorization, and interpretation (Campbell et al., 2021; Lim, 2025). Confirmability was enhanced by grounding findings in participants' accounts and maintaining an analytical record that distinguished participant evidence from researcher interpretation. These procedures strengthened the study's methodological rigour. They supported the credibility of findings on the factors impeding the adoption and integration of AT in inclusive primary education.

RESULTS AND DISCUSSION

Factors Influencing Assistive Technology Adoption and Devices Required

The findings indicate that the adoption of assistive technology (AT) in inclusive primary schools is shaped by the interaction between teachers' recognition of learners' functional needs, the availability and suitability of assistive technology devices (ATDs), teachers' capacity to use the technology, and contextual conditions within the school. Operationally, AT adoption refers not simply to the presence or procurement of technological devices, but to the extent to which teachers recognise a particular learning barrier, identify an appropriate technological response, and incorporate it into teaching, learning, communication, and assessment. The interviews demonstrate that adoption is primarily needs-driven rather than technology-driven. As one teacher explained, "We have different learners in the same classroom. Some have difficulty reading, some cannot see the writing clearly, while others struggle to hear or communicate. Because their needs are different, we also need different forms of assistive technology." This finding positions learner diversity as an important antecedent of AT adoption, indicating that teachers first identify specific barriers and then consider technologies that can address them rather than adopting devices based solely on technological availability.

The interviews also revealed that identifying required ATDs was closely linked to the functional barriers learners experienced. Teachers identified text-to-speech software, audiobooks, reading pens, FM systems, enlarged-print materials and visual aids, speech-to-text software, adaptive writing tools, tablets, educational applications, and augmentative and alternative communication (AAC) tools as relevant supports. One teacher noted, “Some learners can understand the lesson when we explain it orally, but they struggle when they have to read the same information independently. For these learners, text-to-speech or audio materials would make a significant difference because they can listen to the content while following the text.” Another participant emphasised that AT should not be equated exclusively with sophisticated digital technologies: “We should not think that assistive technology always means expensive digital devices. Simple things such as pencil grips, slant boards, large-print worksheets, and visual cards can be very useful for young learners.” These accounts demonstrate that teachers perceived ATDs primarily as mechanisms for removing specific barriers to curriculum access and participation. Accordingly, both high-tech and low-tech solutions were considered valuable when they were affordable, practical, usable, and functionally aligned with learners’ needs.

The findings show that AT availability alone does not guarantee adoption or effective classroom use. Teachers emphasized that adoption requires recognition of learner needs, access to appropriate devices, and teacher readiness. Observations further indicated that learners with reading, writing, sensory, or communication difficulties faced greater barriers when instruction relied on conventional text, oral explanations, board-based instruction, and handwriting. Conversely, adapted materials, visual supports, alternative response modes, and assistive technologies enhanced participation. Overall, teachers identified functional needs, selected appropriate ATDs, and considered availability, usability, and readiness. However, equipment shortages, limited technical knowledge, inadequate training, workload pressures, weak technical assistance, and institutional gaps disrupted implementation. Sustainable AT adoption therefore depends on alignment among learner needs, technological appropriateness, teacher competence, pedagogical relevance, and institutional support.

Table 1. Assistive technology devices required in inclusive primary schools

Assistive technology devices required	Description of the findings
Text-to-speech software	Participants indicate that text-to-speech tools are required to support learners with reading difficulties and visual impairments. Teachers report that audio-supported reading enhances comprehension and learner independence.
Audiobooks and reading	Teachers highlight the need for portable reading support devices

pens	that assist struggling readers in decoding text and following written instructions.
Hearing assistive devices (e.g., FM systems)	Participants emphasise the importance of sound amplification systems to support learners with hearing impairments in mainstream classrooms.
Visual aids and enlarged print materials	Teachers identify the need for magnifiers, large-print books, and visual charts to support learners with visual barriers.
Speech-to-text software	Participants report that learners with writing difficulties require voice recognition tools to assist with written assessments.
Adaptive writing tools (e.g., pencil grips, slant boards)	Teachers highlight low-tech devices that improve fine motor control and writing posture in Foundation Phase learners.
Tablets and educational apps	Participants note the value of interactive digital applications that provide differentiated instruction in literacy and numeracy.
Augmentative and Alternative Communication (AAC) tools	Teachers emphasise communication boards and symbol-based systems to support learners with speech and language difficulties.

Table 1 indicates that inclusive primary schools require a diverse range of assistive technology to address learners' varied reading, writing, sensory, communication, and motor difficulties. The findings demonstrate that both high-tech and low-tech devices are considered important for improving accessibility and participation in mainstream classrooms. Text-to-speech software, audiobooks, and reading pens primarily support learners with reading difficulties, while hearing assistive devices and visual aids address auditory and visual barriers. Speech-to-text software and adaptive writing tools facilitate written expression and motor control. Tablets and educational applications provide opportunities for differentiated, interactive learning, while AAC tools support learners with speech and language difficulties. Overall, the findings suggest that assistive technology should be viewed as an essential component of inclusive education because it promotes learner independence, equitable participation, and access to curriculum content.

Barriers to Assistive Technology Adoption

The findings reveal that the adoption of assistive technology (AT) in inclusive primary schools is influenced by multiple interconnected barriers operating at the resource, professional, pedagogical, and institutional levels. Teachers' experiences indicate that the availability of AT devices alone is insufficient to ensure effective implementation, as limited infrastructure, inadequate training, workload pressures, and unclear institutional support continue to constrain its use. To better represent these barriers, Table 2 presents participating teachers' perspectives, corresponding interview excerpts, and the indicators emerging from the field data.

Table 2. Barriers to Assistive Technology Adoption

Informant Position	Interview Excerpt	Indicator
Classroom Teacher (T3)	"We are expected to use technology, but there are no devices in our classrooms."	Limited availability of AT devices
Classroom Teacher (T7)	"Even if we receive tablets, there is no internet or someone to fix them when they stop working."	Limited connectivity and technical support
Classroom Teacher (T1)	"One device must sometimes be shared by many learners, which defeats the purpose."	Insufficient device-to-learner ratio
Classroom Teacher (T2)	"We were introduced to inclusive education, but not trained on how to use assistive devices properly."	Inadequate AT-specific training
Classroom Teacher (T5)	"I am not confident because I don't fully understand how some of these tools work."	Limited teacher confidence and competence
Classroom Teacher (T8)	"There are no follow-up workshops to help us apply it practically in our classrooms."	Lack of continuous professional development
Classroom Teacher (T4)	"With more than forty learners in one class, it becomes difficult to give individual support."	Large class size
Classroom Teacher (T6)	"Setting up devices takes time, and the curriculum must still be covered."	Limited instructional time
Classroom Teacher (T9)	"Administrative work takes most of our time, so technology becomes secondary."	Administrative workload
Classroom Teacher (T1)	"Policies say we must accommodate all learners, but there is no clear support on how to do it."	Lack of implementation guidance
Classroom Teacher (T5)	"We don't know who is responsible for maintaining these devices."	Unclear institutional responsibility
Classroom Teacher (T7)	"There is guidance on paper, but not in practice."	Policy-practice gap

Table 2 further explains that the barriers to assistive technology (AT) adoption are multidimensional and interconnected, encompassing structural, professional, pedagogical, and institutional factors. At the structural level, limited device availability, inadequate internet connectivity, unequal device-to-learner ratios, and insufficient technical support restrict access to AT. At the professional level, inadequate AT-specific training, limited teacher confidence, and the absence of continuous professional development constrain teachers' capacity to integrate assistive technologies effectively. Meanwhile, large class sizes, limited instructional time, and administrative workloads reduce opportunities for individualized technological support. At the institutional level, unclear responsibilities for device maintenance and gaps between policy expectations and classroom practice further undermine implementation.

The interview data indicate that resource and infrastructure limitations constitute the most immediate barriers to assistive technology (AT) adoption in inclusive primary schools. T3 reported that teachers were expected to integrate technology despite the absence of adequate devices in classrooms. At the same

time, T7 explained that providing tablets did not resolve implementation difficulties because reliable internet connectivity and technical maintenance remained unavailable. T1 further noted that available devices sometimes had to be shared among many learners. These accounts demonstrate that AT adoption depends on more than device procurement; effective implementation requires sufficient devices, reliable connectivity, technical maintenance, and equitable access. The findings therefore reveal a structural mismatch between institutional expectations for technology integration and the material conditions available to teachers and learners.

A second pattern concerns teacher preparedness and the practical conditions surrounding technology integration. T2 explained that although teachers had received general inclusive education training, they had not been adequately prepared to operate assistive devices. T5 similarly expressed a lack of confidence in using some AT tools, while T8 highlighted the absence of follow-up workshops. These professional limitations were compounded by workload pressures. T4 described the difficulty of providing individualized support in classes exceeding forty learners, whereas T6 and T9 emphasized the time required to prepare and operate devices alongside administrative responsibilities. The findings suggest that limited AT use should not be interpreted simply as a lack of teacher willingness. Rather, teachers' capacity to integrate AT is shaped by specialized training, instructional time, class size, technical competence, and competing administrative demands.

The observation findings reinforce the interview evidence by showing how these constraints manifest in classroom practice. In observed lessons, limitations in device availability, technical infrastructure, and preparation time restricted opportunities for learners to use AT consistently. When teachers had to manage large groups while preparing or operating technological tools, individualized support was difficult to sustain. The observations therefore indicate that the effectiveness of AT depends not only on whether technology exists within the school, but also on whether classroom conditions provide sufficient time, technical assistance, and organizational support for meaningful implementation. This evidence further suggests that the transition from AT availability to actual classroom use is vulnerable to practical constraints that may prevent teachers from consistently incorporating assistive technologies into learning activities.

Taken together, the findings identify four interconnected barriers to AT adoption: structural, professional, classroom, and institutional. Structurally, shortages of devices, connectivity, and technical support restrict access. Professionally, inadequate specialized training limits teachers' knowledge, confidence, and capacity to integrate available technologies. At the classroom level, large class sizes, limited preparation time, and administrative workloads constrain individualized technological support. Institutionally, weak policy implementation, unclear maintenance responsibilities, and limited accountability

undermine sustainability. These barriers interact cumulatively, creating a reinforcing system that restricts inclusive practice. Therefore, sustainable AT adoption requires coordinated investment in infrastructure, professional development, technical assistance, workload support, and clear institutional accountability.

Opportunities and challenges for adopting AT

The findings indicate that opportunities and challenges for adopting assistive technology (AT) refer to the potential benefits and practical constraints teachers experience when integrating AT into inclusive primary school classrooms. Opportunities include improved learner participation, accessibility, independence, engagement, differentiated learning, and reduced stigma. In contrast, challenges include inadequate devices, maintenance problems, limited technical support, insufficient teacher training, technological anxiety, and financial constraints. Thus, AT adoption is understood not simply as providing technological devices, but as a process shaped by the interaction between pedagogical potential and the institutional capacity to sustain its use.

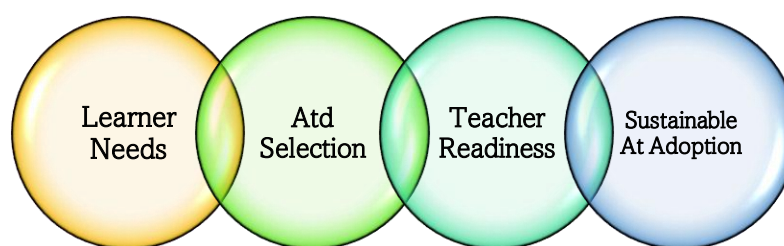


Figure 1. Assistive Technology Adoption Pathway

Figure 1 illustrates a sequential pathway of assistive technology (AT) adoption in inclusive primary schools, beginning with Learner Needs as the foundation of the process. Teachers first identify learners' functional and learning barriers, which informs the ATD Selection stage, where they choose appropriate technologies based on specific needs and pedagogical relevance. The process then depends on Teacher Readiness, reflecting teachers' competence, confidence, and preparedness to integrate AT into classroom practices. Finally, these interconnected stages lead to Sustainable AT Adoption, indicating that long-term implementation requires alignment among learner needs, appropriate devices, teacher capacity, and supportive educational conditions within inclusive primary schools.

The interview findings demonstrate that teachers recognise substantial pedagogical opportunities associated with AT. T2 stated, "If we had the right devices, many struggling learners would participate more confidently." At the same time, T6 explained, "Technology can help learners who cannot read properly to follow the lesson." T8 further noted, "It gives learners a chance to work at their own pace." These accounts indicate that teachers perceive AT as a mechanism for increasing participation, improving access to learning content,

supporting learner autonomy, and facilitating differentiated instruction. However, these opportunities coexist with significant implementation challenges. T1 reported, "Even if we receive devices, they break and are not replaced." At the same time, T7 stated, "There is no technical person at school to assist when problems arise." T3 and T5 also identified technological anxiety and inadequate digital training among teachers. At the same time, T9 and T6 highlighted insufficient budgets and inconsistent reliance on donations. The data therefore reveal a tension between teachers' positive perceptions of AT and the institutional conditions required to realise its potential.

Observation findings indicate that teachers' reported opportunities and challenges were reflected in classroom practices. When AT was available and functional, learners showed greater engagement, independence, and access to instructional materials. Conversely, unavailable devices, technical difficulties, and limited teacher proficiency reinforced implementation barriers. Overall, AT adoption demonstrated a high-opportunity but high-constraint pattern. Teachers perceived AT as valuable for enhancing participation, accessibility, autonomy, differentiation, and inclusive interaction. However, inadequate infrastructure, device maintenance, technical assistance, teacher preparedness, and financial resources limited consistent implementation. Thus, the main challenge is not teachers' recognition of AT benefits but their capacity to translate this recognition into sustainable practice. Successful adoption requires appropriate devices alongside continuous professional development, reliable technical support, sustainable funding, and institutional mechanisms supporting effective integration into inclusive pedagogy.

Discussion

The findings demonstrate that assistive technology (AT) adoption in inclusive primary schools is needs-driven. Teachers first identify learners' functional barriers before selecting appropriate technological responses (Lee & Zhai, 2024). This finding aligns with research showing that AT can improve participation and access when technologies correspond to specific educational needs rather than being introduced as generic digital tools (Oh, 2025; Shankar et al., 2025). UNESCO similarly emphasises identifying barriers and providing appropriate supports for heterogeneous classrooms (Ainscow & Viola, 2024; Castro et al., 2025). The present study extends this perspective by showing that teachers distinguish between high-tech and low-tech solutions, including text-to-speech software, AAC tools, enlarged-print materials, pencil grips, and slant boards (Berner, 2024). Thus, contextual appropriateness may outweigh technological sophistication.

The study further confirms that AT availability alone does not guarantee adoption. Teachers reported inadequate connectivity, maintenance problems, insufficient technical assistance, and unequal device-to-learner ratios (Daltry et al., 2025). These findings correspond with Starks and Reich, who identified

resource allocation, technology access, teacher training, and school decision-making as constraints on technology use in special education. Similarly, review evidence identifies limited systemic support, inadequate resources, technical assistance, and time as barriers to technology-integrated instruction (Akram et al., 2022; Daltry et al., 2025). The findings add insight by showing how these structural limitations become particularly consequential in township primary schools. Thus, AT adoption should be understood as a socio-organisational adoption process.

Teacher competence emerged as a decisive factor in AT implementation and adoption. Participants reported limited confidence, inadequate AT-specific training, and insufficient follow-up professional development. This suggests that teachers may recognise technology's value without possessing the competence required to integrate it well (Ma et al., 2022; Odhus et al., 2024). This is consistent with evidence showing AT training remains inconsistently available. Structured professional development can strengthen teacher confidence and self-efficacy. It also aligns with UNESCO's ICT Competency Framework for Teachers, which positions professional development as essential for appropriate technology use (Vanegas et al., 2025). Therefore, schools should move beyond one-off orientation sessions toward sustained, hands-on, context-specific training supported by technical mentoring.

The findings reveal tension between the perceived pedagogical opportunities of AT and the practical constraints surrounding use. Teachers associated AT with greater participation, independence, accessibility, differentiated learning, and reduced stigma (Angreni et al., 2026). Adapted materials and alternative response modes can facilitate participation among learners experiencing reading, writing, sensory, and communication barriers. This aligns with literature indicating that inclusive technology can reduce exclusion when embedded in practice. However, benefits are conditional. Large classes, limited instructional time, workloads, financial constraints, and weak institutional support and coordination may still prevent teachers from translating positive attitudes into sustained inclusive practice (Chow et al., 2024; Wang, 2026). Thus, effectiveness depends on broader educational context.

Taken together, the study offers a multidimensional explanation of AT adoption, showing that successful implementation requires alignment among learner needs, appropriate devices, teacher competence, classroom conditions, and institutional support (Martin et al., 2025; Park et al., 2025). This extends research examining technological access, teacher training, or structural barriers separately. Recent literature emphasises differentiated teacher training, school-level capacity building, and collaborative support mechanisms for inclusive technology adoption (Cheng et al., 2026). Practically, schools should develop AT provision strategies based on learner profiles, establish maintenance responsibilities, provide continuous teacher professional development, allocate sustainable funding, and integrate AT planning into school inclusion policies (Kayyali, 2024; Yusuf & Fajari, 2025). This approach can support implementation across diverse inclusive primary school settings.

Theoretically, the findings position AT adoption as a contextual pedagogical process rather than procurement alone. Meaningful AT implementation requires structural, professional, pedagogical, and institutional conditions to work together effectively (Bitar & Davidovich, 2024). This perspective explains why acquiring devices may not improve participation or outcomes. Adoption frameworks should also consider learner characteristics, teacher readiness, resource availability, classroom demands, and organisational support. Schools should evaluate AT needs, monitor implementation, strengthen technical assistance, and review provision regularly and systematically. The study therefore offers an integrated framework for understanding how broader contextual conditions ultimately shape sustainable AT adoption within inclusive primary schools.

CONCLUSION

This study concludes that adopting assistive technology (AT) in inclusive primary schools depends not only on the availability of devices, but also on alignment among learners' functional needs, appropriate AT solutions, teacher competence, classroom conditions, and institutional support. The central implication is that technology becomes meaningful when selected based on specific learning barriers and implemented by teachers with adequate knowledge, confidence, and resources to integrate it into daily pedagogical practice. Scientifically, this study contributes to a multidimensional understanding of AT adoption by illustrating how structural, professional, pedagogical, and institutional factors interact within inclusive education, particularly in township school contexts. However, the study is limited by its qualitative approach, the small number of teacher participants, and its focus on selected inclusive primary schools, which may restrict the broader applicability of the findings. Future research should use larger, more diverse samples, longitudinal designs, and mixed-methods approaches to track AT adoption over time and assess how specific technologies support learner participation, independence, and educational outcomes. Practically, the findings suggest that schools, policymakers, and teacher training institutions should prioritize sustainable AT implementation through needs-based technology selection, ongoing professional development, and stronger institutional frameworks to ensure assistive technology effectively supports equitable learning opportunities for students with diverse educational needs.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this article.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that artificial intelligence (AI)-assisted technologies were not used to generate the research findings, conduct data analysis, or replace the intellectual contributions of the authors. If applicable, any use of AI-assisted tools was limited to language refinement, proofreading, and improving the clarity of academic writing. The authors remain fully responsible for the accuracy, originality, integrity, and content of this manuscript.

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