OPEN ACCESS

Int. J. Educ. Found. 03 (04) 2026. 831-837 DOI: 10.33687/ijef.003.04.00180

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IJEF

Available Online at EScience Press
International Journal of Education Foundations
ISSN: 3078-7866 (Online), 3078-7858 (Print)
https://ijef.esciencepress.net

RESEARCH ARTICLE

Assistive Technology and Academic Performance among Students with Visual Impairment: A Case Study of Uhuru Mchanganyiko Primary School, Dar es Salaam, Tanzania

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Author's Contributions
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Article History
Received: August 20, 2026 ; Accepted: September 13, 2026 ; Published: September 24, 2026.

ABSTRACT

This study examined the contribution of assistive technology (AT) to the academic performance of students with visual impairment at Uhuru Mchanganyiko Primary School in Ilala Municipality, Dar es Salaam, Tanzania. The study employed a qualitative approach and descriptive case study design. Data were generated through semi-structured interviews with nine students with visual impairment and five teachers, together with documentary review of relevant school records. Thematic analysis was used to identify patterns in participants' accounts and documentary evidence. Findings indicated that AT contributed to academic learning through improved academic performance, enhanced reading and writing skills, increased classroom participation and independent learning, improved motivation and confidence, and support for examination performance. School records showed that students with visual impairment had achieved a 100% pass rate in Standard Seven national examinations over the previous five years and transitioned to secondary education. The findings also showed individual differences in students' progress, suggesting that the educational value of AT depends on appropriate tools, sustained practice, teacher support, and functional access. The study concludes that AT can facilitate meaningful learning among students with visual impairment when it is available, functional, and appropriately integrated into instruction.

Keywords: assistive technology, academic performance, visual impairment, Braille, inclusive education, Tanzania

INTRODUCTION

Assistive technology (AT) has become an important component of inclusive education because it can reduce barriers that prevent learners with disabilities from accessing information, participating in classroom activities, and demonstrating what they know. For students with visual impairment, technologies and tools such as Braille devices, screen readers, audio materials, magnifiers, and electronic Braille readers can provide alternative ways of accessing curriculum content and completing academic tasks. The educational value of these tools, however, depends not only on their availability but also on their functionality, suitability, user competence, and integration into teaching and learning.

Recent literature indicates that technology-supported learning can improve access and participation for learners with disabilities. Basham et al. (2020) discuss technology-supported learning as a means of increasing access to learning opportunities, while Al

Azawei et al. (2021) emphasize the importance of inclusive learning environments that provide learners with appropriate ways of engaging with educational content. Research specifically involving visual impairment like (Mugo & Wanjiru, 2021; Siddiqua et al., 2022) has similarly reported benefits associated with assistive technology, including improved access to learning materials, participation, independence, and academic activities

Evidence from Tanzania also suggests that assistive technology can support learning among persons with visual impairment. Mnyanyi (2023) reported that ICT-based assistive technology can enhance access to learning and social participation, while Kisanga and Kisanga (2022) found that AT devices can foster participation and learning among students with visual impairment. More recent evidence has continued to show that the educational value of AT is shaped by users' skills, access conditions, and institutional support (Kisanga, 2025; Tuttle & Carter, 2024). These findings indicate that AT should be examined as part of the learning process rather than simply as a collection of devices.

Despite the Tanzanian government's commitment to inclusive education through the Education and Training Policy (2014) and the Education Sector Development Plan (2016/17–2020/21), implementation of assistive technology for learners with visual impairment in schools remains underdeveloped. Many schools have limited assistive technology tools (John & Stackus, 2025), while teachers may lack the skills needed to use these tools effectively. Even where assistive technology is available, it may be inaccessible or underutilized.

The Research Problem

Students with visual impairment require accessible means of engaging with curriculum content, practising literacy skills, completing exercises, and demonstrating achievement. Although assistive technology can support these processes, the presence of devices does not automatically guarantee educational benefit. International studies indicate that AT outcomes depend on appropriate selection, user support, accessibility, and integration into classroom practice (Edyburn, 2021; Tuttle & Carter, 2024). Evidence from Tanzania similarly has documented challenges involving shortages of AT, limited ICT infrastructure, inadequate user knowledge, and constraints in effective implementation (Kisanga & Kisanga, 2021; Kamaghe et al., 2020).

The problem addressed under this study was specifically contextualized to understand how assistive technology contributes to the academic performance of students with visual impairment at Uhuru Mchanganyiko Primary School. Without such evidence, it is difficult to understand the specific learning processes through which AT supports students and the conditions under which its contribution becomes meaningful.

Theoretical Framework

The study was guided by Constructivist Learning Theory, associated with the work of Piaget (1952) and Vygotsky (1978). Constructivism views learning as an active process in which learners develop knowledge through interaction with their environment, learning materials, and other people. Rather than simply receiving information, learners actively make meaning from experiences and available resources. In the context of students with visual impairment, assistive technology can function as an enabling learning resource that provides alternative access to information and opportunities for active participation.

The theory is relevant to this study because AT tools such as Perkins Braille machines, A4 frames with styluses, and electronic Braille devices allow learners to interact directly with learning materials through reading, writing, practising, and completing academic tasks. The theory also accommodates the role of teachers and peers in supporting learning. The dissertation findings show that students with visual impairment sometimes support one another, while teachers monitor their use of devices and provide guidance. From the researcher's perspective, the constructivist framework helps explain why the contribution of AT is reflected not only in examination outcomes but also in students' developing ability to read, write, participate, solve learning tasks, and work independently.

Literature Review

Research on assistive technology and academic performance generally indicates that accessible tools can reduce barriers to learning for students with visual impairment. Siddiqua et al. (2022), using an experimental design among visually impaired university students in Pakistan, reported a significant difference in academic achievement when course content was provided through audio files compared with traditional teaching. Although the study was conducted in higher education, its evidence demonstrates that accessible formats can affect achievement by enabling learners to engage with course content more effectively.

Mugo and Wanjiru (2021) examined assistive technology and learning outcomes among learners with visual impairment in Kenya and reported that AT can support literacy and classroom participation. Their findings are relevant to the present study because reading and writing are foundational processes through which primary-school learners engage with the curriculum. Similarly, Mnyanyi (2023) found that ICT-based assistive technology supported access to online learning, empowerment, and social inclusion among persons with visual impairment in Tanzania. From the researcher's perspective, these studies suggest that academic contribution should be understood through the practical learning activities that AT makes possible.

The literature also emphasizes participation and independence as important dimensions of educational

performance. Kisanga and Kisanga (2022) found that AT devices fostered participation and learning among students with visual impairment in Tanzanian higher education institutions. Tuttle and Carter (2024), through classroom observations, found that AT use varied across learners and academic activities, with reading, writing, and independent instructional tasks showing notable use. These findings suggest that the contribution of AT is closely connected to the learning activity and the learner's opportunity to use the technology meaningfully.

Another issue concerns motivation and confidence. When learners can complete tasks that would otherwise require assistance, AT may increase their sense of competence and willingness to participate. The dissertation evidence from Uhuru Mchanganyiko indicates that students associated the use of assistive tools with feeling happy, competent, proud, and motivated to learn. This complements the broader literature emphasizing learner engagement and independence as important dimensions of technology-supported inclusive education (Al Azawei et al., 2021; Edyburn, 2021). From the researcher's perspective, these affective and participation-related changes are important because they create conditions through which students can engage more actively with academic work.

The reviewed literature nevertheless indicates that positive outcomes are not automatic. Edyburn (2021) argues that assistive technology outcomes depend on appropriate tool selection, training, and integration. Tuttle and Carter (2024) similarly demonstrate variation in use according to learners and classroom activities. In Tanzania, Kisanga (2025) reported differences in students' attitudes toward high-tech AT, while Mnyanyi (2023) highlighted the importance of skills for effective ICT use. The present study therefore examines academic contribution through multiple forms of evidence, including students' and teachers' accounts and school records, while recognizing that factors beyond AT may also influence academic performance.

The knowledge gap arises from the concentration of much Tanzanian research on higher education and from the tendency to examine accessibility, participation, or implementation separately. John and Stackus (2025) provide relevant primary-school evidence concerning accessibility, but the present case focuses specifically on how AT contributes to academic performance and learning experiences within one public primary school. From the researcher's perspective, this context-specific evidence is necessary because the experiences of younger learners cannot automatically be assumed to be the same as those of adults or university students.

METHODOLOGY

The study employed a qualitative research approach and a descriptive case study design. The qualitative approach was appropriate because the study sought to understand participants' experiences and perceptions of how assistive technology contributes to learning, while the case study design enabled an in-depth examination of the phenomenon within its natural school context. The study was conducted at Uhuru Mchanganyiko Primary School in Ilala Municipality, Dar es Salaam, Tanzania. Study participants comprised nine students with visual impairment from Standards Three to Seven and five teachers, giving a total of fourteen participants. Participants were selected purposively because they had direct experience of using, supporting, or teaching students through assistive technology. The students provided firsthand accounts of reading, writing, participation, independence, motivation, and examination experiences, while teachers provided observations of students' learning and classroom participation. Data were generated through semi-structured interviews and documentary review. Interviews were conducted with the nine students and five teachers using open-ended questions addressing the use of AT, academic performance, participation, confidence, independence, and examination experiences. Documentary review was used to complement interview evidence and included relevant school records concerning student academic performance. The use of more than one source strengthened triangulation and enabled the researcher to compare participants' accounts with documentary evidence. Data were analyzed thematically. Interview data were transcribed, read repeatedly, coded, and grouped into categories and themes corresponding to the study objective. Documentary evidence was examined alongside interview accounts to identify areas of convergence and provide additional evidence concerning academic performance. Trustworthiness was strengthened through triangulation of interviews and documentary evidence, systematic recording of the research process, and careful linkage of interpretations to participants' accounts and school records. Ethical procedures included obtaining research permission, informed consent, confidentiality, voluntary participation, and the use of participant codes such as T1, T2, S4, S8, and S9 rather than real names.

FINDINGS AND DISCUSSION

The objective examined how assistive technology contributed to the academic performance of students with visual impairment at Uhuru Mchanganyiko Primary School. Evidence was generated from interviews with nine students and five teachers and from documentary review of school academic records. The thematic analysis produced five closely related dimensions of contribution: improved academic performance, enhanced reading and writing skills, increased classroom participation and independence, improved motivation and confidence, and support for examination performance.

Improved Academic Performance

The findings indicated that assistive technology was associated with improved academic performance among students with visual impairment. T1, a teacher with 22 years of experience, reported that students with visual impairment had achieved a 100% pass rate in Standard Seven national examinations over the previous five years and had transitioned to secondary school. The teacher also reported substantial progress from the time students entered the school to the time they completed Standard Seven, particularly in Braille writing and examination performance.

> *For the past five years, students with visual impairment have achieved 100% pass rate and have joined secondary school. The results are very good. Every student who has been in Standard Seven for the last five years has passed their national Examinations and been accepted to secondary school. This is amazing achievement considering the challenges we face."* (T1, Teacher, 22 years of experience, Interview, 2 June 2026)

Students' accounts provided further evidence of academic development. S9, a Standard Seven student, reported improvement in writing, tests, and examinations and explained that he had progressed from depending on other students to completing his work independently. S4 similarly reported that she had moved from failing to passing after learning to use Perkins Braille and A4 frame technology. S6 described progressive improvement in her understanding and ability to use assistive tools as she advanced through the grades.

> *I improve in writing skills, doing tests, and examinations. Now I am able to do my work alone. When I first came to school, I didn't know how to write Braille."* (S9, Standard Seven student, Interview, 2 June 2026)

Documentary evidence strengthened these accounts. School records indicated that all students with visual impairment who sat for Standard Seven national examinations during the previous five years passed and were selected for secondary education. The records also showed individual academic improvement over time, including one student whose reported performance changed from 20% in Standard Four to 75% in Standard Seven, and another whose performance changed from 35% in Standard Five to 80% in Standard Seven. These records provide evidence of academic progression, although the qualitative design does not establish that AT alone caused the improvements.

The finding is consistent with Siddiqua et al. (2022), who reported improved academic achievement under an assistive-technology-supported learning condition. It also corresponds with Mugo and Wanjiru (2021), who linked assistive technology with learning outcomes among learners with visual impairment. Edyburn (2021), however, cautions that improved outcomes are not automatic and depend on appropriate selection, training, and integration of AT. From the researcher's perspective, the convergence between participant accounts and school records suggests that AT formed an important enabling condition for academic learning at the study site, while other learner and instructional factors should also be recognized.

Enhanced Reading and Writing Skills

Reading and writing emerged as a central area in which students experienced the contribution of assistive technology. S1 reported that A4 frame technology enabled her to write her name, the alphabet, and sentences and to complete examinations. S5 explained that he had improved in reading and writing and could read Braille books and complete activities without someone writing for him. S7 similarly reported that writing helped him remember what he had learned, while S8 explained that repeated use of the machines had increased his writing speed and helped him keep up with the teacher during lessons.

> *I feel to write when I am having these tools. I can read, write and do my examination. When I have my A4flem, I feel happy because I can write like other students. I can write my name, I can write the alphabet, and I can write sentences."* (S1, Standard Three student, Interview, 2 June 2026)

Teachers corroborated these accounts. T4 reported observing students who previously could not write becoming able to produce full paragraphs after practising with their machines. T1 emphasized that reading and writing Braille were foundational skills for accessing the curriculum and that students showed substantial progress from their initial inability to read or write to being able to perform these tasks more fluently.

> *I increase the writing skills. I improve the reading skills. I can do my own activities when I am alone. I don't need someone to write for me anymore. I can read what I have written. I can also read books that have Braille."* (S5, Standard Five student, Interview, 2 June 2026)

The finding is consistent with Mugo and Wanjiru (2021), who associated assistive technology with literacy and participation among learners with visual impairment, and with the evidence reviewed by Basham et al. (2020) concerning technology-supported learning for students with disabilities. From a constructivist perspective,

repeated interaction with accessible tools gives learners opportunities to practise, receive feedback, and construct knowledge through active engagement with learning materials. From the researcher's perspective, the reported development of Braille literacy is one of the clearest mechanisms through which AT contributes to academic performance in the primary-school context.

Increased Classroom Participation and Independence

The findings also showed that assistive technology supported active classroom participation and independent learning. S8 reported that before using the tools she was shy and participated less, whereas she could now ask questions, assist classmates, and participate in classroom activities. S7 reported that he could ask questions, discuss with peers, and complete activities independently. S4 similarly described herself as an active participant who shared views with friends, asked questions, and helped classmates.

> *I can ask question and discuss with my peers. I can do my own activities when I am alone. When I don't understand something, I ask the teacher. Before, I was afraid to ask questions. Now I know that I have the right to learn just like everyone else."* (S7, Standard Six student, Interview, 2 June 2026)

Teachers confirmed these changes. T2 reported that students with visual impairment were increasingly raising their hands, answering questions, and participating like other students. T1 explained that students were not only receiving assistance from peers but were also helping others, suggesting a movement toward greater independence and reciprocal participation. The researcher also recorded an instance in which a student with visual impairment helped a sighted peer understand a concept, providing observational support for the participants' accounts.

> *Students are involving in the classroom by asking questions and answering some questions asked by teachers. Students are able to depend on themselves. I see students with visual impairment raising their hands to answer questions, just like other students. They are not afraid anymore." (*T2, Teacher, 7 years of experience, Interview, 2 June 2026)

These findings correspond with Kisanga and Kisanga (2022), who reported that AT devices can foster participation and learning among students with visual impairment, and with Tuttle and Carter (2024), who found that AT use was particularly relevant to independent academic activities. The finding also fits the constructivist view that learning develops through active engagement and interaction with others. From the researcher's perspective, the contribution of AT should therefore be understood broadly: enabling a learner to participate, ask questions, practise independently, and support peers represents an important educational outcome alongside formal academic scores.

Improved Motivation and Confidence

Students associated assistive technology with positive feelings about learning. S5 reported that the tools made him feel competent and happy when completing exercises. S9 explained that when machines were functioning, he felt motivated and wanted to learn more, whereas lack of access limited his ability to participate in lessons. S4 reported feelings of joy and increased confidence, while S6 described pride after completing written work and receiving positive feedback from teachers.

> *I like to use them because they are helping me to be competent on doing my exercises. These tools make me happy and enjoy my study. When I use my Perkins machine, I feel like I am a real student. I am not different from other students. I can do the same things they can do."* (S5, Standard Five student, Interview, 2 June 2026)

Teachers observed similar changes. T1 explained that students developed confidence as they moved from writing their names to writing complete sentences. T2 also observed that students appeared proud and happy when they completed exercises successfully. These accounts indicate that the contribution of AT was not limited to technical assistance; it also influenced how students perceived their own ability to participate in learning.

> *The use of assistive tools are helping me to understand the lesson, but when I don't have assistive tools, there is no meaning to be in the class. If the machines are not working, I cannot write anything. I just sit and listen. I feel like I am wasting my time. But when the machines are working, I feel motivated. I want to learn more."* (S9, Standard Seven student, Interview, 2 June 2026)

The finding is consistent with the literature emphasizing learner engagement and independence in inclusive technology-supported learning (Al Azawei et al., 2021; Mnyanyi, 2023). It is also compatible with constructivist learning theory because successful interaction with accessible learning tools can create opportunities for learners to experience competence through active participation. From the researcher's perspective, motivation and confidence are important intermediate

learning outcomes because they may encourage students to practise more consistently and engage more actively with classroom tasks.

The Role of Assistive Technology in Examination Performance

Assistive technology was also reported to play an important role in examination preparation and performance. T1 linked the school's strong examination outcomes to students' ability to practise writing, complete exercises, and prepare using functional assistive devices. S8 explained that students used Perkins machines and Braille paper during examinations because the devices enabled them to write answers efficiently. S9 emphasized that access to machines during examinations was essential because without them students would have difficulty producing written responses.

> *The 100% pass rate is directly related to the availability of assistive technology. Students who have access to working machines can practice writing, do exercises, and prepare for examinations. Students who don't have access to machines cannot practice and may fail. We have seen that students who consistently use assistive technology perform better in examinations.* (T1, Teacher, Interview, 2 June 2026)

Documentary evidence indicated that students with visual impairment had consistently performed well in national examinations over the previous five years, with students obtaining Grades A, B, and C. The records also indicated that some students with access to Orbit machines were among those achieving strong results. This observation suggests that the functionality and quality of AT may matter in addition to simple physical availability.

> *During examinations, we use our Perkins machines and Braille paper. The machines help us to write our answers quickly. Without these machines, we would not be able to do the examinations at all. We are grateful that the school provides these machines for us."* (S8, Standard Seven student, Interview, 2 June 2026)

The findings are consistent with Siddiqua et al. (2022), who found improved achievement under an assistive-technology-supported condition. They also reflect Tuttle and Carter's (2024) observation that AT use varies according to academic activity. However, the present qualitative case study cannot establish a causal relationship between AT and examination outcomes because academic achievement may also be shaped by teaching quality, learner characteristics, prior knowledge, attendance, and other school factors. From the researcher's perspective, the evidence supports the interpretation that functional AT provided students with an essential means of practising and demonstrating their learning in examinations.

Overall, the evidence indicates that assistive technology contributed to academic performance through interconnected learning processes rather than through examination scores alone. Students reported improvements in reading and writing, participation, independence, motivation, and confidence, while teachers described similar changes and school records documented positive academic progression. The evidence also showed that these benefits were strongest when students had access to functional devices and opportunities for sustained practice. This interpretation is consistent with Edyburn (2021), who emphasizes that AT outcomes depend on the conditions under which technology is selected and integrated. Within the constructivist framework, AT functioned as a learning resource that enabled students to interact actively with curriculum content, practise skills, and participate in social learning.

CONCLUSION

The study concludes that assistive technology contributed positively to the academic performance of students with visual impairment at Uhuru Mchanganyiko Primary School. Its contribution was evident in improved academic progression, reading and writing skills, classroom participation, independent learning, motivation, confidence, and examination performance. Documentary evidence of sustained examination success and individual academic improvement complemented the accounts provided by students and teachers. Nevertheless, the findings should not be interpreted as demonstrating that AT alone caused academic improvement because the study was qualitative and other educational factors may also have influenced the outcomes. The central conclusion is that functional and appropriately integrated assistive technology can provide an important means through which students with visual impairment access learning, practise academic skills, participate in classroom activities, and demonstrate achievement.

Recommendations

Schools should ensure that assistive technology devices are functional and available when students need them, particularly during daily classroom activities and examination preparation. Teachers should provide regular opportunities for students to practise using assistive technology and should integrate the tools into reading, writing, exercises, and other curriculum activities rather than limiting their use to examinations.

School administrations should strengthen technical support, maintenance systems, and records for

assistive technology so that defective devices are repaired promptly and learning interruptions are minimized. Teacher professional development should include practical training on assistive technology and inclusive instructional strategies so that teachers can support students with different levels of visual impairment and different levels of technological competence. Education stakeholders should consider the availability, functionality, and equitable distribution of assistive technology when planning inclusive education interventions, particularly for younger learners who need sustained opportunities to develop foundational literacy skills.

REFERENCES

Al Azawei, A., Serenelli, F., & Lundqvist, K. (2021). Universal design for learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2020. Journal of the Scholarship of Teaching and Learning, 21(1), 1–20. https://doi.org/10.14434/josotl.v21i1.29367

Basham, J. D., Blackorby, J., Marino, M. T., & Israel, M. (2020). Technology supported learning for students with disabilities. Journal of Special Education Technology, 35(3), 135–146. https://doi.org/10.1177/0162643419882424

Edyburn, D. L. (2021). Rethinking assistive technology outcomes: What do we really know? Journal of Special Education Technology, 36(2), 67–78. https://doi.org/10.1177/0162643420914532

John, B. K., & Stackus, O. (2025). Accessibility of assistive technologies among primary school learners with visual impairments in Tanzania. Eureka: Journal of Educational Research, 3(2), 174–182. https://doi.org/10.56773/ejer.v3i2.71

Kamaghe, J. S., Luhanga, E. T., & Kisangiri, M. (2020). The challenges of adopting M-learning assistive technologies for visually impaired learners in higher learning institution in Tanzania. International Journal of Emerging Technologies in Learning, 15(1), 140–151. https://doi.org/10.3991/ijet.v15i01.11453

Kisanga, D. H., & Kisanga, S. E. (2021). Access to assistive technology among students with visual impairment in higher education institutions in Tanzania: Challenges and coping mechanisms. University of Dar es Salaam Library Journal, 15(2), 137–151. https://doi.org/10.61538/udslj.v15i2.3992

Kisanga, S. E., & Kisanga, D. H. (2022). The role of assistive technology devices in fostering the participation and learning of students with visual impairment in higher education institutions in Tanzania. Disability and Rehabilitation: Assistive Technology, 17(7), 791–800. https://doi.org/10.1080/17483107.2020.1817989

Kisanga, S. E. (2025). Attitudes towards the use of high-tech assistive technology among students with visual impairment in Tanzanian higher education institutions. Disability and Rehabilitation: Assistive Technology, 20(6), 1774–1780. https://doi.org/10.1080/17483107.2025.2475145

Mnyanyi, C. (2023). ICT-based assistive technology for empowering persons with visual impairment. Journal of Issues and Practice in Education, 14(2). https://doi.org/10.61538/jipe.v14i2.1214

Mugo, J., & Wanjiru, K. (2021). Assistive technology and learning outcomes among visually impaired learners with visual impairment in Kenya. African Journal of Disability, 10, 1–10. https://doi.org/10.4102/ajod.v10i0.789

Piaget, J. (1952). The origins of intelligence in children. International Universities Press.

Siddiqua, N., Parveen, N., & Ansari, H. (2022). An experimental study to identify the effect of assistive technology on academic achievement of visually impaired students. Pakistan Social Sciences Review, 6(2), 866–879. https://doi.org/10.35484/pssr.2022(6-II)72

Tuttle, M., & Carter, E. W. (2024). Assistive technology use among students with visual impairments in academic classes. Journal of Special Education Technology, 39(4), 468–480. https://doi.org/10.1177/01626434231217050

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.