ISSN 2962-5548
https://doi.org/10.56773/ejer.v3i2.71
Eureka: Journal of Educational Research, 3(2), 174-182

Accessibility of assistive technologies among primary school learners with visual impairments in Tanzania

Bahati Karusha John[1]*, Okwaput Stackus[2]
[1]Department of Educational Psychology and Curriculum Studies, University of Dodoma, Tanzania
[2]Department of Special Needs Studies, Kyambogo University, Uganda
*karushajb91@gmail.com

Received: January 17, 2025
Revised: January 30, 2025
Accepted: March 3, 2025

Abstract

This study examined the accessibility of Assistive Technologies (ATs) for Learners with Visual Impairments (LwVI) in primary schools in Tanzania. The primary aim was to scrutinize the availability of both high-tech and low-tech ATs, as well as the enabling infrastructure used to enhance the use of ATs in teaching and learning for LwVI. This study employed an exploratory case design within a qualitative approach, in which data were collected through observations and semi-structured interviews and analyzed using thematic data analysis procedures. Data was gathered from five teachers, the Deputy Head Teacher, five LwVI from one primary school, and the District Special Needs Education Officer in the district where the school is located. The study revealed that despite government efforts to promote equitable quality education within an inclusive framework, LwVI in primary schools remain marginalized due to the inadequacy of both low-tech and high-tech ATs, as well as insufficient enabling infrastructure necessary to support their use. This finding is inconsistent with the modern world's emphasis on digitizing education, particularly in ensuring equitable quality education for persons with disabilities. Therefore, a comprehensive approach is needed, including earmarking resources for AT procurement, fostering robust partnerships among stakeholders—including the government and non-governmental organizations—for the acquisition and maintenance of ATs, and upgrading the enabling infrastructure to support their sustainable use. Additionally, there is a need to develop a comprehensive framework for evaluating AT availability and a database for tracking the resources available in schools. These two components should inform policymaking practices and stakeholder decisions.

Keywords

Accessibility, assistive technologies, enabling infrastructure, high- and low-tech, visual impairment.

INTRODUCTION

Assistive Technology accessibility is now important and a must rather than an option to guarantee that everyone, including those with visual impairment access equitable and quality education as inclusive education and technology revolution becomes the heart of education systems today [1], [2]. It is a necessity for children with disabilities including those with visual impairments to crack the locked world of education systems [3]. Visual impairment is a global concern; its implications for people's lives, including those in schools, give rise to challenges. This condition is referred to as a loss in visual functioning that is irreversible or not correctable by any kind of medical treatment [4]. People with visual impairments range from low

vision 6/12 to 3/60 efficiency in visual acuity to blindness 3/60 efficiency in visual acuity (ICD, 2018) in all age groups. It is estimated that more than 1 billion people of different ages, including children in schools, live with various forms of visual impairments, and this number continues to increase due to lifestyle factors and aging [5]. These individuals have consistently been constrained by unfavorable educational systems worldwide. Physical and socioeconomic barriers, including discrimination, stigma, and stereotypical behaviors, limit their ability to perform Activities of Daily Living (ADLs), including those related to education [6]–[8]. Given this situation, learners require services facilitated by ATs, such as auditory communication tools, tactile materials, speech synthesis, and Braille production technologies, to name a few [9].

In today's world where systems of life technologically upturned, assurance in educational accessibility through technology is the talk of the majority [1], [10]–[14]. Accessible ATs for inclusive education are advocated through both international and national frameworks. The Convention on the Rights of Persons with Disabilities (CRPD), in Article 4 (1g, h), requires signatory states to ensure access to ATs to achieve the goal of educational accessibility for all, without discrimination, as enshrined in Article 24. Additionally, Article 24 (5) obliges countries to provide reasonable accommodations through new technologies for children with disabilities, including those with visual impairments [15]. The World Health Organization (WHO) has also demonstrated its commitment through various programs, including the Global Disability Action Plan 2014–2021, which emphasizes promoting access to ATs for persons with disabilities [16]. In 2014, WHO launched the Global Cooperation on Assistive Technology (GATE) program, identifying sixteen (16) ATs that countries should adopt for individuals with visual impairments. Additionally, the World Health Assembly resolution (WHA17.8) was established to strengthen global partnerships in developing and reinforcing policies and programs that ensure access to ATs for essential services, including education for children with visual impairments [17].

The above efforts have not been in vain, this is due to the reasons that in advanced societies, particularly in Europe and United States of America efforts have been made to ensure accessibility to ATs for people with disabilities including those with visual impairments in schools [18], [19]. Related to this, the Global Report on Assistive Technology (GReAT) states that 90% of those who need assistive technology have access to it, while only 10% have yet to gain access [20]. On the other hand, although efforts have been made in developing countries, especially in South Africa, Ghana, Kenya, Nigeria, India, and Tanzania, researchers have identified a persistent gap between those who have access to ATs and those who do not in their learning [21], [25]. Similarly, the GReAT report indicates that the access rate in developing societies is only 3%, highlighting the severity of the situation and the urgent need for a solution.

Like other developing countries, Tanzania ratified the CRPD and its Optional Protocol in 2008 and 2019, respectively [26]. Since then, the government has focused on ensuring access to education for children with disabilities including those with visual impairments in inclusive classrooms [27], [28] The use of technology, assistive technology in particular is advocated through a range of frameworks and policies including the National Policy on Disability, 2004, Persons with Disability Act, 2010, Education and Training Policy 2024, 2023 Edition, National Policy on ICT, 2016 and an overall National Strategy for Inclusive Education 2021/22-25/2026 which guides and requires the Ministry of Education Science and Technology (MoEST) to ensure provision of equipment and tools including ATs for teaching and learning. Following that call, the government, in collaboration with NGOs and other stakeholders, has been equipping primary schools with ATs, including those designed to help pupils with visual impairments access all learning opportunities. Increasing access to ATs has been and continues to be one of the key strategies toward achieving inclusive education objectives [29]. Although various researchers emanating from urban Tanzania provide a revelation of the effort and report the influence of assistive technology for academic performance of pupils with disabilities and special needs, they scantly report the availability of assistive devices in primary schools such as Slates and styluses, Perkins brailler, abacuses, and enlarged Prints [30]–[32] However, some of the studies are based in Higher Learning Institutions [33] and others, besides of being focused on Vocational

Education are based on the role of ATs for other impairments, such as hearing impairments specifically [34]. As such, despite the existing policy framework regarding the use of assistive technology in Tanzania, there is a scarcity of information on the extent to which LwVI are accessing ATs in their learning. This study was, therefore, designed to bridge that information gap.

RESEARCH METHOD

This study adopted a case study design with a qualitative research approach to investigate the extent to which ATs are available for learners with visual impairment. The choice of the design was based on the assumption that it would enable the researcher to obtain detailed information on the available ATs and the factors that might be affecting the use of ATs [35]. The study was conducted in one administrative district in Tanzania, where an inclusive primary school was selected. The school had an enrollment of 756 children with normal vision and 39 children with visual impairments. Children with visual impairments were placed in the same classrooms and studied alongside their peers. At the time of the study, the school had 19 teachers, including 9 who were trained to teach learners with disabilities, including those with visual impairments, and 10 who taught other learners. The aim was to capture the lived experiences of key stakeholders (teachers, the head teacher, LwVI, and the District Special Needs Education Officer) regarding the availability of ATs.

Research participants

The study participants comprised five (5) teachers who were teaching LwVI, five (5) LwVI who were purposively selected from lower, middle, and upper classes, the deputy head teacher, and a District Special Needs Education Officer. Teachers were selected based on their experience of teaching LwVI for at least two years. The District Special Needs Education Officer was chosen due to his crucial role in handling issues related to special educational needs, including ensuring that ATs are available, suitable, and usable in schools. The deputy head teacher was conveniently selected based on the understanding that he was readily available and represented the head teacher in the school's day-to-day administration, specifically ensuring that ATs were in place, supervising teachers in using them, and ensuring that LwVI had access to them in their various academic activities.

Data gathering procedures

Data were collected using observations and semi-structured interviews. An observation checklist and interview guides were prepared after a thorough review of the literature on categories of ATs available for LwVI and their usage. Semi-structured interviews were conducted with LwVI, teachers, the deputy head teacher, and the Special Needs Education Officer to obtain their lived experiences regarding ATs and the enabling infrastructure. Additionally, observations were carried out to confirm the availability, status, and condition of ATs and the enabling infrastructure.

Data analysis

The data were analyzed following the thematic data analysis procedures outlined by Braun and Clarke [36]. The process involved transcribing the data, categorizing it, and identifying subthemes and patterns. After a thorough examination of the data and recurring patterns, codes were assigned and subsequently organized into themes within which the data are presented. Participants' expressions are also presented verbatim to support the findings and maintain originality.

Ethical attentions

Ethical considerations, such as obtaining participants' consent, avoiding deception, and ensuring privacy and confidentiality during data collection, were upheld [37]. Credibility and trustworthiness were also ensured through data source triangulation, incorporating observations and interviews to align with the research topic and minimize potential bias in the findings. Data were gathered from diverse categories of participants, including teachers, students, and district and school administrators, with the aim of maximizing a wide range of inferences and minimizing bias. Furthermore, the study was conducted in a natural setting, where verbatim accounts from participants regarding the accessibility of ATs were collected, presented, and discussed with utmost honesty to prevent any form of misrepresentation.

RESEARCH RESULTS

The data show that the school has two main categories of ATs: low-tech and high-tech ATs.

Low-tech ATs available in the school

The data show that various low-tech ATs are available in the school. Table 1 presents the number in each category, their operational status, and their intended use.

Table 1. Low-tech ATs available for LwVI in primary school X

Item available	User Category	Available	No. Operational	Use
Manual Perkins brailler	Blind	23	15	Writing
Electric Perkins brailler	Blind	4	1	Writing
A4 frames/slates	Blind	30	30	Writing
Stylus	Blind	30	30	Writing
White cane	Blind	20	20	Mobility
Abacus	Blind	7	7	Counting
Card stock papers	Blind	5 boxes	All	Writing
Monocular lenses	Low vision	7	7	Reading
Raised maps	Blind	3	3	Teaching
Enlarged books	Low vision	21	21	Reading
Radios	Blind & low vision	1	1	Entertainment

Table 1 indicates that the school has a very limited collection of low-tech ATs available for teaching and learning for both LwVI and blind learners, with many of them being non-existent. Most of the desirable low-tech ATs for these learners, such as counting blocks, lensed spectacles, sunglasses, ear/headphones, binocular lenses, Victor readers, table lamps, and electronic magnifiers, were not available. Furthermore, some of the available ATs were not in use due to various faults and a lack of timely repair and maintenance. The data also show that most of the available ATs are intended for teaching and learning of blind learners, with only a limited number designed for learners with low vision.

When participants were asked whether they were aware of the availability of low-tech ATs, one of the participants said:

> *AD 2: We have ATs for writing, reading and moving. In writing, we have slates not forgetting stylus. We also have machines, which are being used, but also, we have those that are multipurpose, example handheld lenses. In short, I would say that these devices are inadequately available.*

Another one had this to say:

> *TLVI 2: I think we have the ordinary ones. We have A4 frames being used. We also have these Abacus; we have slates and the visual text. I think, we also have the white cane which are also being used.*

The data also reveal that only a few teachers and learners with visual impairment could mention more than three ATs, which implies that others were unaware of the availability of low-tech AT categories in the school. This is evidenced by participants (LwVI 3, TLVI 3), who stated: "*We have lenses, sun glasses. Yeah, only those"* (LwVI 3).

Another participant said*: "Aaah…here, we have Perkins braille and slates only, may be a white cane too"* (TLVI 3).

The data further indicates that although some ATs are accessible and utilized by teachers and LwVI, others are rarely used. Participants could only mention a Perkins Brailler, an A4 frame, and a white cane, but were unable to name others such as an abacus, enlarged books, cardstock papers, a radio, and raised maps. This suggests that the lack of awareness and utilization of these ATs may be a barrier for LwVI in accessing information, which could, in turn, lead to poor academic performance.

High-tech ATs available in the school

During the observations conducted by the researcher with the aid of an observation checklist, the availability of high-tech ATs was noted. The available high-tech ATs are presented in Table 2, categorized by user group, quantity available, and number in operation.

Table 2 shows that the school has a limited number of high-tech ATs. Moreover, the data indicate that most of the available high-tech ATs are not operational. Many high-tech ATs, such as computers with assistive software (screen readers and screen magnifiers), digital recorders, smart

boards, scanners, OCR and OCR software, projectors, digital books/DAISY, and Android smartphones, are unavailable in the school. To validate these findings, the researcher conducted semi-structured interviews with participants, who also expressed the opinion that high-tech ATs were extremely scarce in schools. When asked to list the high-tech ATs available in the school, one of the participants said:

Table 2. High-tech ATs available for LwVI in school X

Items	User category	No. of available	No. of operational
Closed circuit Televisions	Low vision	2	0
Embossers	Blind	2	0
Duxbury Braille Translator (DBT)	Blind	2	0
Braille duplicators/ Thermoform	blind	1	0
Printers	Low vision	2	1
Photocopy machine	Low vision	1	1
Desktop computer	Blind & low vision	2	2

TLVI 1: *The technologies we have, I can say there is an embosser, and the embosser does not go alone, it goes with the computer, so we also have computers, but we also have special CCTV for learners with low vision*.

Another participant said:

TLVI 5: *We have high-tech ATs such as an embosser, but we also have technologies such as thermoform that we also use to duplicate braille text, we have technologies such as desktop computers that help us at the moment, although they are not sufficient in number and these do not have programs*.

The data suggests that LwVI in primary schools have limited access to the quality and equitable education they deserve. This is because most high-tech ATs that could facilitate easy access to learning are unavailable in schools, while the few that are available are not operational. This suggests that teachers and LwVI in the school are not utilizing high-tech ATs. Instead, they rely on low-tech ATs such as Perkins braillers, slates and styluses, and white canes, which limit teaching and learning.

Another emerging issue is that, due to the scarcity of high-tech ATs, teachers are forced to use their smartphones for teaching LwVI to help them access lessons. This was revealed by one participant, who said: "*Here if you have the materials in the smart phone, you give them and they benefit through audio"* (TLVI 4).

This narration suggests that smartphones are among the high-tech ATs that can be used for teaching and learning of LwVI. The use of personal smartphones helps ensure that lessons are accessible to all learners, including those with visual impairments.

Availability of infrastructure to enable the use of ATs

The study examined the availability and condition of infrastructure supporting the use of ATs. Data was collected through interviews and corroborated with observations. Table 3 presents the available infrastructure and identifies gaps in provision. The results are as follows.

Table 3. Infrastructure to enable the use of ATs

Items	Available	Status
Computer laboratory	none	-
Resource room	none	-
Electricity	available	unstable
Shelves in classrooms	none	-
Internet connectivity	none	-
Tables in classrooms	none	-

Table 3 indicates that electricity is the only available infrastructure in the school; however, its connectivity is unstable. The school lacks essential facilities such as a computer laboratory,

resource rooms, shelves, and large tables in classrooms. When asked about the availability of enabling infrastructure for AT utilization, one of the participants stated:

> *TLVI 1: Here we have electricity, which enables us to use these devices. Mm…we do not have library or resource rooms. The tables used are those of the desk structure, which are not good for Perkins use, there are no shelves or cupboards. This is an office and everything is kept in here*.

Another participant said:

> *TLVI 2*: *Mm…there are no big tables; this is because the classrooms are overcrowded with many students. There are no lockers so they walk with their equipment. Regarding the internet, no, here we always use personal phones and we have the electricity although not stable*.

Similarly, another one said:

> *AD2: Aaah, there is electricity, though erratic at the moment. We do not have a library and a special room, and not even a computer lab. We only have a storage area, which is the head unit's office. Therefore, it is a problem*.

Moreover, the data reveals that the limited ATs available are stored in offices due to the absence of a resource room. This situation may prevent LwVI from accessing and using the ATs outside lesson time, potentially restricting their access to essential information.

The findings suggest that the use of ATs in primary schools remains a challenge due to poor infrastructure. ATs require adequate support, including reliable internet connectivity, stable electricity, and sufficient space for both usage and storage. The lack of proper infrastructure may, therefore, continue to hinder the effective use of ATs in teaching and learning for LwVI.

DISCUSSION

The existing advancements in technology have sparked debates on whether low-tech ATs or high-tech ATs work best for learners with visual impairments. Some scholars, such as Kirboyun [38], argue that low-tech ATs are no longer useful for LwVI and that high-tech ATs should be prioritized instead. However, Chukwuemeka and Samaila [39] contend that while high-tech ATs are more effective, they are expensive and difficult to obtain, whereas low-tech ATs are more accessible and easier to use. Despite these arguments, a body of literature, including Conderman [40] and Jadhav et al. [22], observes that individuals with visual impairments have diverse needs. This suggests that an AT suitable for one learner may not necessarily be suitable for another. Therefore, it is essential to provide both categories of ATs, allowing learners to choose what best meets their needs.

The findings align with those of Senjam et al. [41], who report that 70% to 90% of schools had slates with styluses, braille typewriters, braille reading books, enlarged prints, and long canes (white canes). However, other adapted low-tech ATs, such as Tylor frames and smartwatches, were found in small quantities or were entirely absent from schools. Senjam et al. further highlight that low-tech ATs were insufficient, potentially hindering educational accessibility for LwVI. Similarly, Wilfred [30] observed that while slates with styluses, Perkins braillers, and white canes were present in 30%–64% of schools, other ATs, such as tape recorders, braille globes, and radios, were available in less than 5%. The author emphasizes that low-tech ATs were extremely scarce in primary schools. This limited accessibility to ATs increases the likelihood that LwVI will fall behind their sighted peers in education.

Furthermore, the findings align with those of Wong and Cohen [42], who observed that high-tech ATs available in schools included computers, embossers, JAWS, CCTVs, and ZoomText. Similarly, a study by Alimi et al. [25] reported that some schools had 52.5% of talking computers, 52.1% of embossers, and 52.1% of screen readers and note-takers, all of which were utilized to support the teaching and learning of LwVI. These studies suggest that a range of high-tech ATs can be implemented to facilitate learning for both teachers and LwVI. Likewise, Drigas and Ioannis [43] and Assie [24] have identified computers, CCTVs, tape recorders, voice synthesizers, and braille converter software as essential tools for LwVI to access information, interact, and actively engage in lessons. Therefore, it is crucial for schools to invest in modern and advanced high-tech ATs to ensure inclusive and equitable learning opportunities for

learners with low vision and blindness in primary schools.

Moreover, the results indicate that despite advancements in digital technology, the school has yet to gain access to most high-tech or digital ATs that could enhance the teaching and learning of LwVI. In this context, mobile devices, particularly Android smartphones, are recognized by teachers in primary schools as accessible and practical ATs that can support LwVI in accessing educational opportunities. These findings align with Retorta and Cristovao [44], who discovered that teachers were utilizing smartphones as assistive technology to effectively teach English to LwVI. Similarly, Wu et al. [45] affirm that smartphones equipped with assistive applications play a crucial role in teaching writing to LwVI. These insights highlight the need for authorities to consider integrating and promoting the use of smartphones with assistive applications, as they offer a more cost-effective alternative to many high-tech or digital ATs currently available in the market.

Lastly, the DeLone and McLean Information System Success Model suggests that essential quality provisions—such as electricity, libraries, resource rooms, and computer labs—should serve as the foundation for the effective use of ATs [46]. The findings of this study align with Wilfred [30], who identifies poor infrastructure, including unreliable electricity and insufficient classroom space, as key barriers to AT utilization in schools. Similarly, Odeke-Nato [47] observes that inadequate infrastructure, particularly poor internet connectivity, limits the effective use of ICT-based AT tools. However, this finding contrasts with Odeke-Nato's [47] observation in Uganda, where most schools had dedicated resource rooms for ICT tools, allowing students to use them without distractions.

CONCLUSION

This study highlights the challenges faced by primary school LwVI in accessing and utilizing ATs in their education. Despite government efforts to promote quality and equitable education, the findings reveal significant inadequacies in both low-tech and high-tech ATs, insufficient infrastructure, and limited awareness among educators and learners regarding the appropriate ATs for LwVI. As a result, these learners face restricted access to inclusive educational opportunities. These findings underscore the urgent need for a comprehensive and collaborative approach, including the allocation of resources for AT procurement at the school level. Additionally, fostering partnerships with key stakeholders—such as the government and non-governmental organizations—can play a critical role in ensuring the provision of necessary ATs, maintenance services, and enabling infrastructure to enhance the education of LwVI.

REFERENCES

[1] A. Gronlund, N. Lim, and H. Larsson, "Effective Use of Assistive Technologies for Inclusive Education in Developing Countries : Issues and challenges from two case studies Åke Grönlund Nena Lim Hannu Larsson Örebro University , Sweden," *Int. J. Educ. Dev. using Inf. Commun. Technol.*, vol. 6, no. 4, pp. 5–26, 2010.

[2] B. Hajduk and I. Ali, "Study of accessibility needs of people with visual impairments and how they align with WCAG 2.0 guidelines," Blekinge Institute of Technology, 2023.

[3] J. Opie, "Technology Today: Inclusive or Exclusionary for Students with Vision Impairment?," *Int. J. Disabil. Dev. Educ.*, vol. 65, no. 6, pp. 1–15, Feb. 2018.

[4] S. Naipal and N. Rampersad, "A review of visual impairment," *African Vis. Eye Heal.*, vol. 77, no. 1, pp. 1–4, Jan. 2018.

[5] R. Bourne *et al.*, "Trends in prevalence of blindness and distance and near vision impairment over 30 years: an analysis for the Global Burden of Disease Study," *Lancet Glob. Heal.*, vol. 9, no. 2, pp. e130–e143, 2021.

[6] N. Jones, H. E. Bartlett, and R. Cooke, "An analysis of the impact of visual impairment on activities of daily living and vision-related quality of life in a visually impaired adult population," *Br. J. Vis. Impair.*, vol. 37, no. 1, pp. 50–63, Jan. 2019.

[7] J. Bornman *et al.*, *Understanding Education for the Visually Impaired*, vol. 1. AOSIS, 2021.

[8] RNIB, "Key statistics about sight loss," United Kingdom, 2021.

[9] Grace Nyagah, Reuben Nguyo Wachiuri, and Rosemary Imonje, "Relative Advantage of

Assistive Technology in the Teaching and Learning of Integrated English Among the Visually Impaired Learners in Special Secondary Schools in Kenya," *US-China Educ. Rev. A*, vol. 7, no. 1, pp. 39–48, Jan. 2017.

[10] F. K. Ahmad, "Use of Assistive Technology in Inclusive Education : Making Room for Diverse Learning Needs," *Transcience*, vol. 6, no. 2, pp. 62–77, 2015.

[11] M. A. Nees and L. F. Berry, "Audio assistive technology and accommodations for students with visual impairments: Potentials and problems for delivering curricula and educational assessments," *Perform. Enhanc. Heal.*, vol. 2, no. 3, pp. 101–109, Sep. 2013.

[12] O. Metatla, "Uncovering Challenges and Opportunities of Including Children with Visual Impairments in Mainstream Schools," in *Proceedings of the 31st International BCS Human Computer Interaction Conference*, 2017, vol. 2017-July, pp. 1–7.

[13] O. Metatla *et al.*, "Inclusive Education Technologies: Emerging Opportunities for People with Visual Impairments," in *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, 2018, pp. 1–8.

[14] O. Metatla, A. Oldfield, T. Ahmed, A. Vafeas, and S. Miglani, "Voice User Interfaces in Schools: Co-designing for Inclusion with Visually-Impaired and Sighted Pupils," in *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, 2019, pp. 1–15.

[15] United Nations [UN], *Convention on the Rights of Persons with Disabilities and Optional Protocol*. 2006, pp. 1–28.

[16] V. Tangcharoensathien, W. Witthayapipopsakul, S. Viriyathorn, and W. Patcharanarumol, "Improving access to assistive technologies: challenges and solutions in low- and middle-income countries," *WHO South-East Asia J. Public Heal.*, vol. 7, no. 2, p. 84, 2018.

[17] WHO and UNICEF, *Global report on assistive technology. Geneva: License CC BY-NC-SA 3.0 IGO*. Geneva: World Health Organization and the United Nations Children's Fund (UNICEF), 2022.

[18] UNESCO, *Global education monitoring report 2020: Inclusion and education: All means all*. Paris: UNESCO, 2020.

[19] N. M. D'Cunha, S. Isbel, J. Goss, L. Pezzullo, N. Naumovski, and D. Gibson, "Assistive technology, information asymmetry and the role of brokerage services: a scoping review," *BMJ Open*, vol. 12, no. 12, p. e063938, Dec. 2022.

[20] UNICEF ECARO, "Bulding an ecosystem to Support Assistive Technology Access in Armenia," Norway, 2022.

[21] S. Senjam, "Assistive technology for students with visual disability: Classification matters," *Kerala J. Ophthalmol.*, vol. 31, no. 2, pp. 86–91, 2019.

[22] V. Jadhav, D. Chambers, and D. Tatpuje, "Low-tech Assistive Technology to Support Students with Disability in Low-income Countries," in *International Perspectives on Inclusive Education*, vol. 14, 2020, pp. 37–50.

[23] Z. Trafford, E. van der Westhuizen, S. McDonald, M. Linegar, and L. Swartz, "More Than Just Assistive Devices: How a South African Social Enterprise Supports an Environment of Inclusion," *Int. J. Environ. Res. Public Health*, vol. 18, no. 5, p. 2655, Mar. 2021.

[24] R. A. Assie, "Availability of Assistive Technology Devices for Students with Visual Impairment : Evidence from the University of Cape Coast," *Glob. Sci. J.*, vol. 9, no. 2, pp. 413–434, 2021.

[25] A. E. Alimi, E. O. Babalola, G. A. Aladesusi, A. I. Issa, and E. V. Omolafe, "Availability and Utilization of Assistive Technology for Learning among Students with Special Needs in Ilorin, Kwara State," *Indones. J. Community Spec. Needs Educ.*, vol. 2, no. 1, pp. 17–28, Dec. 2021.

[26] United Nations Convention on the Rights of Persons with Disabilities, *Views adopted by the Committee under article 5 of the Optional Protocol, concerning communication No. 22/2014*. 2017.

[27] M. K. POSSI and J. R. MILINGA, "Special and Inclusive Education in Tanzania: Reminiscing the Past, Building the Future," *Educ. Process Int. J.*, vol. 6, no. 4, pp. 55–73, Dec. 2017.

[28] S. Revelian and E. R. Tibategeza, "Effective Implementation of Inclusive Education in Enhancing Quality Education in Public Primary Schools in Tanzania: The role of school culture," *J. Humanit. Educ. Dev.*, vol. 4, no. 1, pp. 190–199, 2022.

[29] E. S. Kisanga, "It is not our Fault. We are the Victims of the Education Systems: Assessment of

the Accessibility of Examinations and Information for Students with Visual impaiment in Tanzania," *J. Int. Assoc. Spec. Educ.*, vol. 19, no. 1, pp. 37–44, 2019.
[30] J. Wilfred, "Influence of assistive technology utilization on academic performance of pupils with disabilities In Tanzanias primary school," Doctoral Thesis, 2017.
[31] R. Eliuteri and V. Lema, "Assessing the Access to Assistive Devices by Special Education Need Students in Morogoro Municipality," *East African J. Educ. Stud.*, vol. 5, no. 3, pp. 288–300, Nov. 2022.
[32] H. Mwangakala, P. R. Manyengo, and E. Mlaki, "Learning with Albinism: Potential of Digital Technologies in Enhancing Learning Environment for Visually Impaired Pupils." pp. 1–11, 22-Jun-2023.
[33] K. Dalton H and K. Sarah E, "Access to assistive technology among students with visual impairment in higher education institutions in Tanzania," *Univ. Dar es Salaam Libr. J.*, vol. 15, no. 2, pp. 137–151, 2020.
[34] K. Dalton, D. Wambura, and F. Mwalongo, "Exploring Assistive Technology Tools and E-Learning User Interface in Tanzania's Vocational Education Institutions," *Int. J. Educ. Dev. Using Inf. Commun. Technol.*, vol. 14, no. 3, pp. 50–71, 2018.
[35] J. W. Creswell and J. D. Creswell, *Research designs: Qualitative, Quantitative and Mixed method approaches*, 5th ed. London, United Kingdom: SAGE Publications, 2018.
[36] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qual. Res. Psychol.*, vol. 3, no. 2, pp. 77–101, Jan. 2006.
[37] M. Vicars, S. Steinberg, T. McKenna, and M. Cacciattolo, *The Praxis of English Language Teaching and Learning (PELT)*. Rotterdam, Netherlands: SensePublishers, 2015.
[38] S. Kirboyun, "High-Tech or Low-Tech? Impact of Assistive Technology in School Settings for Students with Visual Impairments: Review of Research," *Int. J. Infonomics*, vol. 13, no. 1, pp. 1945–1953, Mar. 2020.
[39] E. J. Chukwuemeka and D. Samaila, "Teachers' Perception and Factors Limiting the use of High-Tech Assistive Technology in Special Education Schools in North-West Nigeria," *Contemp. Educ. Technol.*, vol. 11, no. 1, pp. 99–109, Nov. 2019.
[40] G. Conderman, "Assistive Technologies: A Lifeline for Learning," *Kappa Delta Pi Rec.*, vol. 51, no. 4, pp. 173–178, Oct. 2015.
[41] S. S. Senjam, A. Foster, and C. Bascaran, "Barriers to using assistive technology among students with visual disability in schools for the blind in Delhi, India," *Disabil. Rehabil. Assist. Technol.*, vol. 16, no. 7, pp. 802–806, Oct. 2021.
[42] M. E. Wong and L. G. Cohen, "Access and Challenges of Assistive Technology Application: Experience of Teachers of Students with Visual Impairments in Singapore," *Disabil. CBR Incl. Dev.*, vol. 26, no. 4, p. 138, Feb. 2016.
[43] A. Drigas and I. Kostas, "On Line and other ICTs Applications for teaching math in Special Education," *Int. J. Recent Contrib. from Eng. Sci. IT*, vol. 2, no. 4, pp. 46–53, Oct. 2014.
[44] M. Retorta and V. Cristovão, "Visually-Impaired Brazilian Students Learning English with Smartphones: Overcoming Limitations," *Languages*, vol. 2, no. 3, p. 12, Jul. 2017.
[45] Z. Wu *et al.*, "LightWrite: Teach Handwriting to The Visually Impaired with A Smartphone," in *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 2021, pp. 1–15.
[46] W. H. DeLone and E. R. McLean, "Information Systems Success Measurement," *Found. Trends® Inf. Syst.*, vol. 2, no. 1, pp. 1–116, 2016.
[47] J. Odeke-Nato, "Information and Communication Technology (ICT) in Teacher Education: Towards facilitating conducive learning environments for learners with visual impairment," Doctoral Thesis, 2021.