Journal of Education and Practices
Vol 3 Issue No.3. November, 2023. PP 60-70. ISSN 2617-5444

ENHANCING ACADEMIC ACHIEVEMENT IN INCLUSIVE EDUCATIONAL SETTINGS: PERCEIVED INFLUENCE OF ASSISTIVE TECHNOLOGY DEVICES FOR LEARNERS WITH LOW VISION IN RUCHU AND ITHIRU WARD, KANDARA CONSTITUENCY

Lucy Wangechi Ngundo and Waweru Muriithi
School of Education, Bomet University College, Kenya
Corresponding Author's Email: luwange@gmail.com

Abstract

Inclusive educational settings strive to cater to the distinctive needs of students with low vision, encompassing their physical, social, and emotional requirements while nurturing academic excellence. This study explored the perceived influence of Assistive Technology Devices (ATDs) on the academic performance of students with low vision, a pivotal aspect of inclusive education. The objective was to assess the availability and adequacy of ATDs' influence on the educational achievement of learners with low vision. The study was grounded in Rogers' Theory of Diffusion of Innovations and the Inclusive Education Framework. The study employed a mixed-methods approach targeting 4623 learners, 123 teachers, and 11 head teachers within the public primary schools located in Ruchu and Ithiru Wards, Kandara Constituency. Using purposive sampling, learners in grades five, six, seven, and eight with low vision were selected, resulting in a sample size of 460 students. Additionally, employing systematic random sampling with a kth number of three, a total of 153 learners were selected for the sample. Out of the 64 teachers from Ruchu, 21 were sampled, and out of 59 teachers from Ithiru, 20 teachers were systematically sampled through random sampling, resulting in a total of 41 teachers. The eleven head teachers from the selected schools were automatically included in the study, resulting in a total sample size of 205 respondents. The researchers employed various measures to ensure the reliability and validity of the research tools. Data collection methods included structured questionnaires for students with low vision and teachers, an interview schedule for head teachers, and a checklist. Analysis from the checklist revealed a range of available ATDs, such as braille, large print materials, and magnifiers, but highlighted the absence of advanced high-tech AT devices, like digitally recorded communication tools, alternate adapted mice, and alternative keyboards. Head teacher interviews revealed financial constraints in obtaining specialized ATDs, leading to resource-sharing among students. Research data from the respondents indicated that the scarcity of high-tech assistive technologies and inadequate ATDs significantly affected the academic performance of learners with low vision. This study recommends increased funding for advanced AT devices, improved resource allocation and access, regular assessment and upgrading of resources, and professional development for teachers to effectively integrate assistive technologies in the classroom. These measures aim to enhance the overall educational experience and outcomes for students with low vision within inclusive educational settings.

Keywords: *Assistive Technology Devices; Academic Performance; Low Vision; Inclusive Education*

Introduction

The World Health Organization (WHO) has reported that a staggering 2.2 billion individuals worldwide grapple with visual impairment or blindness (World Health Organization, 2022). Furthermore, researchers highlight a concerning statistic regarding children who are blind on a

global scale: nearly one-third of these children, approximately 419,000 of them, reside in sub-Saharan Africa (Asferaw, Woodruff & Gilbert, 2017). Among this group, a significant number of children are affected by functional low vision, while an even larger cohort faces challenges stemming from uncorrected refractive errors (Gilbert & Lepvrier-Chomette, 2019). The WHO's International Classification of Diseases (ICD-10) provides a specific definition for individuals with low vision, categorizing them as those with visual acuity ranging from 6/18 to 3/60 in their better eye and a field of vision spanning 20 to 30 degrees (World Health Organization, 2022). The repercussions of vision impairment are profound and multifaceted, significantly impacting various facets of students' lives, given its direct influence on their day-to-day activities.

Article 24 of the United Nations Convention on the Rights of Persons with Disabilities (2006), outlines the unequivocal educational rights of children with disabilities. These rights encompass the entitlement to receive "inclusive, high-quality, and cost-free primary and secondary education" at all educational stages, integrated within the "mainstream education system." This educational provision is designed to foster the development of their "individuality, skills, and imaginative capacities," nurturing their cognitive and physical capabilities. Additionally, it equips them with the essential life skills and social competencies required for active engagement in both educational pursuits and community life.

The UNESCO-published Global Education Monitoring Report (GEM) also directed its attention towards the theme of inclusion, specifically focusing on the challenges and prospects of educating children with visual impairments in Sub-Saharan Africa. This report drew inspiration from General Comment 4 issued by the Committee of the Convention on the Rights of Persons with Disabilities (CRPD) in 2016. The aforementioned Comment explicitly emphasized that inclusive education revolves around ensuring the full and effective participation, accessibility, attendance, and achievement of all students, with particular emphasis on those who, for various reasons, face exclusion or the risk of marginalization (UNESCO 2019). This report was dedicated to promoting inclusive and fair access to high-quality education and fostering lifelong learning opportunities for all by the year 2030, as envisioned by UNESCO in 2021 (Alvarez-Peregrina, Villa-Collar, Andreu-Vázquez & Sánchez-Tena, 2021).

General Comment 4 of the UN Convention on the Rights of Persons with Disabilities (UNCRPD) in 2016 underscored that the realization of inclusive education hinges upon the complete accessibility of educational systems. This encompassed various facets, such as physical infrastructure, information and communication channels, assistive technologies, devices, curricula, educational resources, teaching methodologies, assessment procedures, and language support services.

Vision holds particular significance in children, and visual impairment has been associated with lower academic performance (Shin, Park & Park, 2009; Toledo, Paiva, Camilo, Maior, Leite & Guerra, 2009; Martinez-Perez, 2020). In today's educational landscape, the visual demands placed on children within the classroom have notably increased. Students engage in a wide array of visual activities during their school days, including reading, writing, and utilizing tablets and computers. Notably, in 2016, primary school children in Australia spent 47% of their school time engaged in near tasks, 29% on distance tasks, 15% on activities transitioning between near and far, and only

9% on computer-based tasks (Narayanasamy, Vincent, Sampson & Wood, 2016). Therefore, when a child's vision is compromised and does not function optimally, it significantly hampers their active participation and engagement in the classroom therefore impacting their academic achievement.

Previous research in Kenya has predominantly focused on understanding the prevalence, incidence, and causes of visual impairment among children in the country (Muma & Obonyo, 2020; Bastawrous et.al; 2016; Ndegwa, Karimurio, Okelo & Adala, 2006). However, there has been a notable gap in exploring the impact of assistive technology (AT) on the academic performance of learners with low vision. This study aimed to address this gap by investigating the influence of AT on the educational outcomes of learners with low vision to enhance inclusivity in Kenya.

Objective of the Study

To determine the influence of assistive technology devices for learners with low vision in enhancing academic achievement in Ruchu Ward, Kandara Constituency.

Research Questions

What is the influence of assistive technology devices for learners with low vision in enhancing academic achievement in Ruchu Ward, Kandara Constituency?

Literature Review

Assistive Technology Devices often referred to as ATDs comprise a vast array of devices and services intended to enhance and support the abilities of individuals with disabilities (Dell, Newton, & Petroff, 2012; Abbott, Brown, Evett, Standen & Wright, 2011; IDEA, 2004). The Foundation for Assistive Technology (FAST) expands on this concept, defining ATD as any product or service uniquely crafted to promote independence, serving both individuals with disabilities and older individuals (WHO, 2018).

These ATDs encompass an extensive range of external products, such as low-vision aids, large print books, liquid-level sensors, and computer software. These are specifically designed and customized to achieve a common objective: preserving or amplifying an individual's capabilities and independence, thereby facilitating their active participation in society and enhancing overall well-being. The scope of assistive technology spans from uncomplicated, low-tech tools like walking canes to highly intricate, specialized technologies, as exemplified by specialized computer hardware and software (Senjam, 2019). Assistive technology for individuals with visual impairments, encompassing those with low vision or complete blindness, relies on diverse sensory channels beyond the sense of sight. These include touch, vibration, auditory cues, and even olfaction. An illustrative example is the use of tactile systems such as Braille and embossed print, which rely on the sense of touch to convey information to individuals with visual impairments. Recent years have witnessed substantial advancements in AT, particularly in more industrialized regions, with the aim of enhancing the quality of life for individuals facing visual challenges.

Despite the impressive strides in AT development, a universally accepted, all-encompassing classification system tailored specifically to the needs of individuals with visual impairments remains conspicuously absent. This gap is particularly noticeable within the context of student learning and teaching. Although special educators, scholars, and occupational therapists have made endeavors to categorize AT for visual impairment, these initiatives often lack explicit references to the unique requisites of students facing visual impairments. As such, this research paper will adopt the classification framework proposed by The American Foundation for the Blind as a means to categorize assistive technology for students who are blind or have low vision (D'Andrea & Siu, 2015; American Foundation for the Blind [AFB], 2015).

Countries like Kenya face the challenge of limitations in availability and access to appropriate assistive technology devices. Even when such devices are available, effectively integrating them to enhance the teaching and learning process remains a significant hurdle, particularly within inclusive primary schools. Previous studies by Jwaifell and Gasaymeh (2013), indicated that teachers exhibited positive attitudes toward using interactive whiteboards in inclusive settings. Additionally, Kapperman, Kelly, and LeRette-Kauffman (2021), conducted a study on the use of the JAWS Screen Reader and a Refreshable Braille Display by students who are blind in foreign language studies. Hemmingsson, Nyagah, Grace, Nguyo, Reuben, and Imonje (2017), explored the relative advantage of assistive technology in the teaching and learning of integrated English among visually impaired learners in special secondary schools in Kenya. Similarly, studies by Hussin (2013) and Rukwaro et al. (2018) investigated the potential impact of optical low-vision devices on reading outcomes among learners with low vision at Thika Primary School for the Visually Impaired, Kenya. However, the findings of this study could not also be generalized to a broader context. Despite this existing literature, there is a gap in thoroughly exploring the impact of assistive technology on the academic achievements of learners with low vision. Therefore, this study aims to investigate the perceived influence of assistive technology devices on the academic achievement of learners with low vision in inclusive primary schools.

Table 1: Types of Assistive Technologies for Students with Visual Impairments

Types of Technology	**Devices**
Technology for accessing print material	lighting, handheld and stand magnifiers, telescopes, video magnification systems, scanning and optical character recognition(OCR) systems, electronic whiteboards, Braille reading, tactile graphics, digital talking books, e-book readers, talking calculators, talking dictionaries
Technology for accessing electronic information	cursor-enlarging software, screen magnification software, accessible personal digital assistant (PDA), large print, online dictionaries, refreshable Braille displays, touch tablet, text reader, self-voicing applications, e-book reader, digital voice recorder
Technology for producing written communications	Felt-tip pen and bold marker, dedicated word processor, imaging software, drawing software, math software and spreadsheets, slate and stylus Braille writer, electronic Braille writer, Braille translation software, Braille embosser, accessible PDA

Theoretical Framework

This study employed Rogers' Theory of Diffusion of Innovations, as developed by Everett Rogers in 1962. Rogers' theory encompasses key factors like compatibility, complexity, trialability, relative advantage, and observability. The choice to use Rogers' theory was driven by its ability to assess various facets that contribute to the successful integration of assistive devices in the teaching and learning process. By utilizing this theory, the study could gain valuable insights into the dynamics surrounding the adoption of ATDS, pinpoint crucial factors affecting its efficacy, and formulate strategies for optimizing its influence on the teaching and learning experiences of learners with low vision in inclusive schools in Kenya. The study also adopted the Inclusive Education Framework which provides a strong theoretical foundation and guiding principles that resonate with the objectives and focus of the study. It underscores the importance of ensuring equitable access, participation, and quality education for all students, including those with disabilities, aligning with the research's aim to enhance academic achievement through the integration of assistive technology for learners with low vision.

Methodology

This study employed a mixed-method approach within a descriptive survey research design. Kandara constituency. Simple random sampling was employed to target public primary schools in Ruchu and Ithiru wards for the study. Employing the recommended survey sample size of 10 to 30%, six schools were sampled from a total of 22 public primary schools in Ruchu ward, and five schools were sampled from the 15 public primary schools in Ithiru ward, resulting in a total of 11 public primary schools for the study. The target population consisted of 2249 learners, 64 teachers, and six head teachers from Ruchu, and 2374 learners, 59 teachers, and five head teachers from Ithiru, making a combined total of 4757 individuals. Using purposive sampling, learners in grades five, six, seven, and eight with low vision were selected, resulting in a sample size of 460 students. Additionally, employing systematic random sampling with a nth number of three, a total of 153 learners were selected for the sample. Out of the 64 teachers from Ruchu, 21 were sampled using systematic random sampling, and out of the 59 teachers from Ithiru, 20 teachers were sampled, resulting in a total of 41 teachers. The eleven head teachers from the selected schools were automatically included in the study, resulting in a total sample size of 205 respondents. The researchers employed various measures to ensure the reliability and validity of the research tools. These measures included conducting a pilot test to assess the consistency of responses over time and calculating Cronbach's alpha coefficient to evaluate the internal consistency of the questionnaires. This was carried out with respondents from two schools within the Ruchu and Ithiru wards but who did not take part in the actual study. Content validity was confirmed through expert consultations, while construct validity was established through a comprehensive factor analysis. Additionally, concurrent validity was ensured through comparisons with existing, validated tools in the field. Data collection instruments included structured questionnaires for students with low vision and teachers, as well as an interview schedule for head teachers. The researcher also employed a checklist. Quantitative data obtained from the structured questionnaires underwent descriptive analysis using the SPSS 24 software. Qualitative data from interviews underwent thematic analysis, and NVivo software was utilized to streamline the analysis process.

The quantitative data was presented through frequency tables, while qualitative data was presented through narratives and quotes (Creswell & Creswell, 2018).

Findings

Types of Assistive Technologies available

Table 2: Types of Assistive Technologies devices in Primary schools in Ruchu and Ithiru wards

Type of Assistive Technologies	Ruchu ward		Ithiru Ward	
	Availability	**Number**	**Availability**	**Number**
Braille devices	Yes	56	Yes	44
Large print materials	Yes	120	Yes	80
Screen magnification software	Yes	52	Yes	38
Tactile graphics and raised-line drawings	Yes	45	Yes	30
Jaws	Yes	22	Yes	13
Closed Circuit Televisions (CCTVs)	Yes	7	Yes	3
Audiobooks	Yes	3	Yes	4
Touch tablet	Yes	2	Yes	2
Speech output devices	Yes	8	Yes	5
Dolphin pen	Yes	5	Yes	5
Digitally recorded communication devices	No	-	No	-
Alternative keyboard	No	-	No	-
Alternate adapted mouse	No	-	No	-
Lighting and contrast enhancements	No	-	No	-

Results presented in Table 2 unveiled the presence of a variety of assistive technology devices (ATDs) within the educational settings under examination. Among these braille, large print materials, and magnifiers emerged as the most commonly accessible ATs. However, it was notably observed that advanced high-tech AT devices, such as digitally recorded communication tools, alternative keyboards, alternate adapted mice, and lighting and contrast enhancements were conspicuously lacking.

These findings were further substantiated by insights garnered from interviews with 11 head teachers. Head teachers collectively highlighted the formidable challenge of procuring specialized ATs, primarily due to limited financial resources. Consequently, learners were compelled to share the available resources, including braille machines and screen magnifiers. This practice of resource sharing appeared to have an impact on the academic performance of learners, a sentiment echoed by Head teachers.

Table 3: Perceived influence of low vision devices (ATDs) and academic performance of learners with low vision

Participants group	Affected Academic Performance	Proportion	Percentage
Teachers	41	28	68.29
Head teachers	11	7	63.63
Learners with low vision	153	95	62.09

The analysis revealed the proportions and percentages of each participant group that perceived the influence of the provision of assistive technology devices (ATDs) on academic performance. Teachers accounted for 68.29% of the participants, while head teachers represented 63.63%. Additionally, learners with low vision reported a proportion of 62.09%. These findings offer valuable insights into the diverse perspectives of the participant groups concerning the effects of ATD provision on academic performance.

Adequacy of Assistive Technology

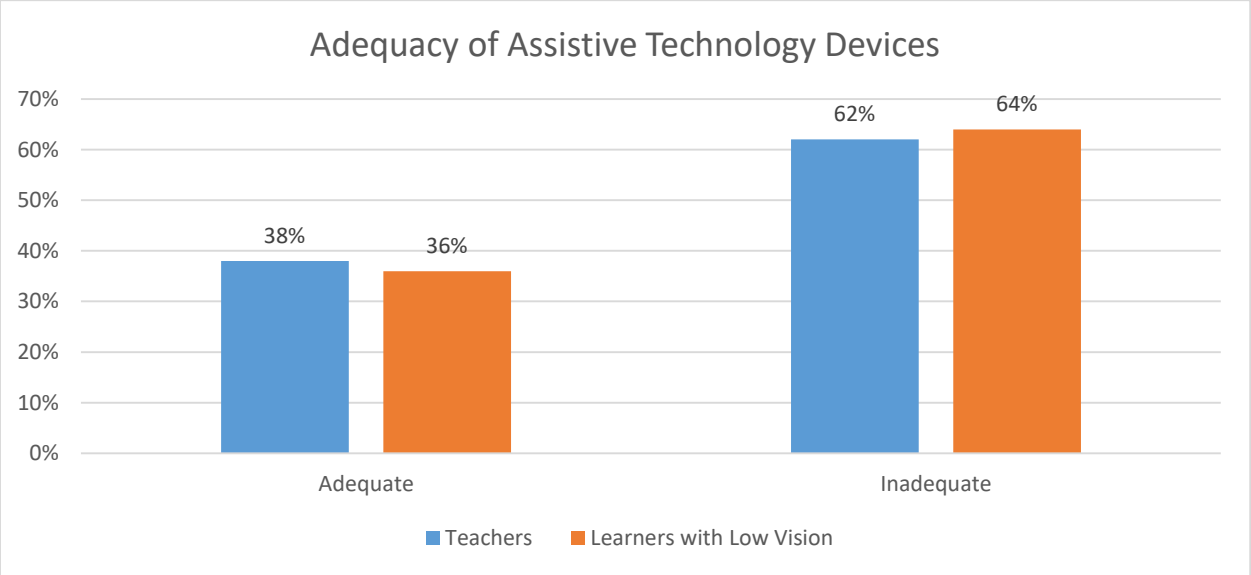

Figure 1: Adequacy of Assistive Technology Devices

Based on the research findings, the sufficiency of AT received ratings indicating inadequacy from 62% of teachers and 64% of learners with low vision (LWLV). Conversely, 38% of teachers and 36% of LWLV considered the availability of ATDs to be adequate.

The study highlighted a prevalent issue in public primary schools, where a majority of them lacked the essential Assistive Technology Devices (ATDs) necessary to facilitate inclusive education for learners with low vision (LWLV). This deficiency posed a significant barrier to the academic performance of LWLV, as they encountered substantial challenges in traditional learning methods. Consequently, the inadequacy of ATs could potentially account for the noticeable academic performance gap between LWLV and their typically sighted peers in public schools.

To provide further support for these results, insights from interviews conducted with the head teachers, based on the academic records of the learners, indicated that students with low vision demonstrated notably lower performance levels in comparison to their sighted peers," said Head teacher C. "According to Head teacher D, students with low vision exhibited comparatively inferior academic performance across various subjects, particularly in the field of sciences, which he attributed to the limited accessibility of advanced technology essential for comprehending complex concepts."

Similarly, Head teacher G corroborated these sentiments by highlighting that, "in their school, the top-ranking student might rank significantly lower, possibly at the tenth position. This trend signifies that their non-visually impaired peers are achieving superior academic results, which he attributed to the absence of high-tech devices and the inadequacy of available assistive technology resources."

Conclusion

The research highlighted a significant absence of advanced high-tech assistive technology devices (ATDs) within the educational environments examined, including digitally recorded communication tools, alternate adapted mice, and alternative keyboards. Additionally, both teachers and head teachers, as well as learners with low vision, consistently emphasized the insufficiency of available ATDs. The findings of the study indicated that the lack of access to high-tech assistive technology and the inadequacy of ATDs had a detrimental impact on the academic performance of students with low vision, representing a considerable obstacle to the advancement of inclusive education

Recommendations

The study's recommendations emphasize the importance of allocating resources to acquire and implement advanced high-tech assistive technology devices in educational settings, particularly for schools serving students with low vision. Additionally, the study advocates for enhanced accessibility of these devices for students with low vision, along with providing training and professional development for educators to effectively integrate and utilize various assistive technologies. Regular assessments and technology upgrades are also highlighted to ensure the continuous improvement of the learning environment for students with low vision. These recommendations collectively aim to foster a more inclusive educational experience and support the academic success and well-being of students with low vision.

References

Abbott, C., Brown, D., Evett, L., Standen, P., & Wright, J. (2011). *Learning difference and digital technologies: a literature review of research involving children and young people using assistive technologies 2007-2010.*

Alvarez-Peregrina, C., Villa-Collar, C., Andreu-Vázquez, C., & Sánchez-Tena, M. Á. (2021). *Influence of Vision on Educational Performance: A Multivariate Analysis. Sustainability,* 13(8), 4187. https://doi.org/10.3390/su13084187

American Foundation for the Blind, AFB. (2015). *Assistive technology at their disposal: Through Texas school for the visually impaired and Perkins School for the Blind*. Arlington, CA: American Foundation for the Blind

Asferaw, M., Woodruff, G., & Gilbert, C. (2017). Causes of severe visual impairment and blindness in students in schools for the blind in Northwest Ethiopia. *BMJ Global Health*, 2, e000264. doi:10.1136/bmjgh-2016-000264

Bastawrous, A., Mathenge, W., Wing, K., Rono, H., Gichangi, M., Weiss, H. A., Macleod, D., Foster, A., Burton, M. J., & Kuper, H. (2016). Six-Year Incidence of Blindness and Visual Impairment in Kenya: The Nakuru Eye Disease Cohort Study. Invest. *Ophthalmol. Vis. Sci*., 57(14), 5974-5983. https://doi.org/10.1167/iovs.16-19835.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Los Angeles: SAGE.

D'Andrea, F. M., & Siu, Y. (2015). Students with visual impairments: Considerations and effective practices for technology use. In D. Edyburn (Ed.), *Advances in Special Education Technology,* Vol. 1, Efficacy of Assistive Technology Interventions. United Kingdom: Emerald.

Global Education Monitoring Report Team [1018], & Sightsavers [1]. (2020). *Education of children with visual impairments in Sub-Saharan Africa: Challenges and opportunities* (Document code: ED/GEMR/MRT/2020/P1/24).

Hemmingsson, H., Lidström, H., & Nygård, L. (2009). Use of assistive technology devices in mainstream schools: Students' perspective. *The American Journal of Occupational Therapy*, 63(4), 463-472.

Individuals with Disabilities Education Act of 2004.

Kapperman, G., Kelly, S. M., & LeRette-Kauffman, H. (2021). The Study of Russian as a Foreign Language for English-Speaking Braille Readers Using the Job Access with Speech or NonVisual Desktop Access Screen Reader and a Refreshable Braille Display. *Journal of Visual Impairment & Blindness*, *115*(4), 347-351.

Waifell, F., & Gasaymeh, A. (2013). Using the Diffusion of Innovation Theory to Explain the Degree of English Teachers' Adoption of Interactive Whiteboards in the Modern Systems School in Jordan. *Contemporary Educational Technology*, 4(2), 138-149.

Marino, M., Sameshima, P., & Beecher, C. (2009). Enhancing TPACK with assistive technology: Promoting inclusive practices in pre-service teacher education. *Contemporary Issues in Technology and Teacher Education,* 9(2), 186-207.

Martinez-Perez, C., Alvarez-Peregrina, C., Villa-Collar, C., & Sánchez-Tena, M. Á. (2020). Current state and future trends: a citation network analysis of the academic performance field. *International Journal of Environmental Research and Public Health*, 17(15), 5352.

Muma, S., & Obonyo, S. (2020). The prevalence and causes of visual impairment among children in Kenya – the Kenya eye study. *BMC Ophthalmology*, 20, 399. doi:10.1186/s12886-020-01665-w

Narayanasamy, S., Vincent, S. J., Sampson, G. P., & Wood, J. M. (2016). Visual demands in modern Australian primary school classrooms. *Clinical and Experimental Optometry*, 99(3), 233-240.

Ndegwa, L. K., Okelo, R. O., Karimurio, J., & Adala, H. S. (2006). Prevalence of visual impairment and blindness in a Nairobi urban population. *East African Medical Journal*, 83(4), 69-72.

Ndegwa, L. K., Karimurio, J., Okelo, R. O., & Dala, H. S. (2006). *Prevalence of visual impairment and blindness in a Nairobi urban population.*

Newton, D. A., & Dell, A. G. (2011). Assistive Technology. *Journal of Special Education Technology*, 26(3), 47-49. https://doi.org/10.1177/016264341102600305

Nyagah, Grace & Nguyo, Reuben & Imonje, Rosemary. (2017). 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 Education Review A. 7. 10.17265/2161-623X/2017.01.003.

Rukwaro, Richard, Juma, Samuel, Kibet, Gideon, Kiarie, Jane, Muga, John, Wambua, Timothy, & Chege, Lydia. (2018). Can Optical Low Vision Devices Improve Reading Outcomes among Learners with Low Vision? A Case of Thika Primary School for the Visually Impaired, Kenya. *International Journal of Science and Research* (IJSR), 8, 1242-1246.

Senjam, S. (2019). Assistive technology for students with visual disability: Classification matters. *Kerala Journal of Ophthalmology*, 31.

Shin, H. S., Park, S. C., & Park, C. M. (2009). Relationship between accommodative and vergence dysfunctions and academic achievement for primary school children. *Ophthalmic and Physiological Optics*, 29(6), 615-624.

Siu, Yue-Ting & D'Andrea, Fm. (2015). Students with visual impairments: Considerations and effective practices for technology use. In D. Edyburn (Ed.), *Advances in Special Education Technology*, Vol. 1, Efficacy of Assistive Technology Interventions. United Kingdom: Emerald.

Toledo, C. C., Paiva, A. P. G., Camilo, G. B., Maior, M. R. S., Leite, I. C. G., & Guerra, M. R. (2010). Early detection of visual impairment and its relation with school effectiveness. *Revista da Associação Médica Brasileira*, 56, 415-419.

UNESCO Institute for Statistics. (2019). *The Use of UIS Data and Education Management Information Systems to Monitor Inclusive Education*. UIS, Quebec.

United Nations. (2016). General Comment No.4. Article 24: *Rights to Inclusive Education. Convention on the Rights of Persons with Disabilities*. United Nations, New York.

United Nations. (2006). *Convention on the Rights of Persons with Disabilities and Optional Protocol*. United Nations, New York.

United Nations Educational, Scientific and Cultural Organization. (2019). *Concept Note for the 2020 Global Education Monitoring Report on Inclusion*. UNESCO: Paris.

World Health Organization. (2018, May 18). Assistive technology. Retrieved from https://www.who.int/news-room/fact-sheets/detail/assistive-technology

World Health Organization. (2022). *Global report on blindness*. World Health Organization

World Health Organization. (2019). *World report on vision*. World Health Organization

World Health Organization. (2011). *World report on disability 2011*. World Health Organization.