European Journal of Special Education Research
ISSN: 2501 - 2428
ISSN-L: 2501 - 2428
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejse.v12i7.7014 Volume 12 | Issue 7 | 2026

THE RELATIONSHIP BETWEEN THE IMPLEMENTATION OF THE ASSISTIVE TECHNOLOGY POLICY AND LEARNER PARTICIPATION AMONG LEARNERS WITH VISUAL IMPAIRMENT IN SPECIAL JUNIOR SCHOOLS IN KENYA

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Abstract:
Assistive technologies play a critical role in reducing barriers to learning for learners with visual impairment, yet evidence linking policy implementation to actual learner participation remains limited, especially in specialised school settings. This manuscript, drawn from a broader doctoral study, examined the relationship between the implementation of the Assistive Technology Policy and learner participation among learners with visual impairment in Special Junior Schools in Kenya. Guided by Bronfenbrenner's Ecological Systems Theory, the study adopted a descriptive mixed-methods design. Data were collected from 246 respondents drawn from a target population of 642 across four purposively and cluster-sampled Special Junior Schools. Questionnaires were administered to teachers and learners, while headteachers participated in interviews. Quantitative data were analysed using descriptive statistics and binary logistic regression, while qualitative data were analysed thematically. Teachers reported high implementation of the Assistive Technology Policy ($M = 3.94$, $SD = 0.77$), while learners reported very high implementation ($M = 4.43$, $SD = 0.88$). Devices such as Braille machines, Orbit Readers, screen readers and magnifiers were reportedly available, maintained and regularly used. Regression analysis showed that policy implementation significantly predicted learner participation ($B = 2.341$, $p < .001$, $Exp(B) = 10.388$) and remained significant in the combined policy model ($B = 1.644$, $p < .001$, $Exp(B) = 5.174$). Headteachers further highlighted early exposure to assistive devices, teacher

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support and adapted classrooms as important enablers. The study concludes that effective assistive technology policy implementation substantially enhances learner participation and recommends sustained investment in procurement, maintenance, equitable distribution and continuous teacher training.

Keywords: Assistive Technology Policy; learner participation; visual impairment; Special Junior Schools; inclusive education; Kenya; Ecological Systems Theory

1. Introduction

Learners with visual impairment often experience exclusion from meaningful learning activities because of inadequate support services and limited adaptation of educational environments, a pattern that persists in Kenya despite the development of policies intended to promote inclusive and participatory education. Among these, the Assistive Technology Policy provides a framework for the provision, accessibility, utilisation, and maintenance of assistive devices and specialised technologies that facilitate learning among learners with disabilities. For learners with visual impairment specifically, assistive technologies bridge the gap created by visual limitations by enabling independent access to information, communication, mobility, and classroom instruction, through devices such as Braille machines, Braille embossers, screen readers, refreshable Braille displays, optical character recognition devices, magnifiers, talking calculators, tactile diagrams, and other digital assistive tools.

The integration of assistive technologies into teaching and learning enables learners with visual impairment to participate actively in classroom discussions, assessments, independent study, collaborative learning, and co-curricular activities, while also enhancing their confidence, communication skills, self-efficacy and academic performance by reducing barriers associated with inaccessible instructional materials. Consequently, the availability, accessibility, and effective utilisation of assistive technologies are considered fundamental determinants of learner participation.

This manuscript addresses the fourth objective of a broader doctoral study on the implementation of educational policies and learner participation among learners with visual impairment in Special Junior Schools in Kenya: to establish the relationship between the implementation of the assistive technology policy and learner participation among learners with visual impairment in Special Junior Schools in Kenya. The study was guided by the corresponding null hypothesis that there is no statistically significant relationship between the implementation of the assistive technology policy and learner participation among learners with visual impairment in Special Junior Schools in Kenya.

2. Literature Review

2.1 Conceptualising the Assistive Technology Policy

In this study, the implementation of the assistive technology policy was conceptualised as the availability, accessibility, and utilisation of specialised facilities, assistive devices, and technologies designed to support learners with visual impairment, including Braille machines, screen readers, tactile learning materials, magnifiers, and other ICT-based assistive technologies. Learner participation, the outcome variable, was understood as the extent to which learners actively engage in classroom learning, co-curricular activities, school decision-making processes, interaction with teachers and peers, and access to learning through assistive technologies and digital learning platforms.

2.2 Empirical Literature

International evidence consistently demonstrates the positive contribution of assistive technologies to educational participation among learners with disabilities. A comparative analysis found that learners with visual impairment who had access to appropriate assistive technologies demonstrated significantly higher levels of classroom participation, academic achievement, and independent learning than those without such support (Allam & Martin, 2021). Similarly, a study on the redesign of computer science instruction for students with visual impairments reported that assistive technologies substantially improved learners' ability to access curriculum content, communicate effectively, and participate actively in educational activities (Tripathi & Thakkar, 2025). Other studies emphasise that technology alone is insufficient: successful implementation of inclusive education depends largely on teachers' competence in utilising assistive technologies alongside differentiated instructional strategies (Montenegro-Rueda & Fernández-Batanero, 2022), and assistive technologies are most effective when complemented by accessible learning environments, appropriate teacher preparation, and institutional support (Fernandes *et al.*, 2021).

Within Africa, studies continue to report substantial challenges relating to the availability and utilisation of assistive technologies. Research on inclusive primary schools in Tanzania found that shortages of Braille materials, audio instructional resources, and specialised assistive devices significantly limited learner participation among learners with visual impairment (Kiomoka, 2024). Comparable evidence from Botswana indicated that although the country had made progress in promoting inclusive education, inadequate assistive technologies continued to constrain learners' access to curriculum content and classroom participation (Mukhopadhyay *et al.*, 2021), while research involving learners with visual impairment in South African higher education similarly linked inadequate provision of specialised equipment to reduced independence and participation (Chivandire & Vincent, 2021).

Evidence from Kenya reflects similar, though geographically varied, challenges. Studies have reported that many schools serving learners with visual impairment

continued to experience shortages of Braille equipment, screen readers, tactile learning materials, and other specialised instructional resources, compounded by inadequate teacher training in the use of assistive technologies (Nyaboke *et al.*, 2021), and that many schools lacked sufficient technological infrastructure and specialised equipment to support learners with visual impairment effectively (Kibet *et al.*, 2020). More specialised inquiries have similarly found that assistive technologies improved curriculum coverage and enabled learners with visual impairment to complete assignments more effectively (Oira, 2021), that inadequate assistive resources limited participation among learners with low vision in Tharaka Nithi County (Njeru *et al.*, 2024), that integration of assistive technologies in Mathematics instruction remained limited in Siaya County (Onyancha, 2020), that assistive audio-visual technologies were in short supply and underutilised in inclusive primary schools in Turkana County (Ejore, 2019), and that assistive technologies were often limited in number, poorly maintained, and inadequately integrated into teaching in schools for learners with hearing challenges in Meru and Tharaka Nithi counties (Murithi, 2022).

Overall, the reviewed literature consistently demonstrates that assistive technologies enhance learner participation by improving curriculum accessibility, communication, independent learning, and classroom engagement. However, most previous studies have concentrated on the availability of assistive devices rather than examining how the implementation of the Assistive Technology Policy specifically influences learner participation among learners with visual impairment in Special Junior Schools in Kenya, and limited empirical evidence exists on the combined influence of policy implementation, teacher competence, and technological provision. This gap provided the basis for the present study.

3. Theoretical Framework

The study was anchored on Bronfenbrenner's Ecological Systems Theory (EST), which explains human development, and by extension educational participation, as the outcome of continuous interaction between individuals and the multiple environmental systems within which they live. For the assistive technology, the theory's tiered structure is particularly instructive. At the microsystem level, assistive technologies directly shape learners' daily interactions with teachers, peers, instructional materials, and classroom activities by reducing the barriers associated with visual impairment. At the ecosystem level, decisions relating to the procurement of assistive devices, teacher preparation, maintenance of technological resources, and financial investment create conditions that either facilitate or constrain learner participation, even though learners do not interact directly with the institutions making these decisions. These ecosystem decisions are, in turn, shaped by the macrosystem, through national educational policies governing inclusive education and disability support. EST was therefore considered appropriate because it frames the influence of assistive technology policy on learner participation as

operating through a chain of interconnected systems, from national policy through institutional procurement and teacher practice to the learner's immediate classroom experience.

4. Methodology

The study adopted a descriptive research design within a mixed-methods approach, considered appropriate for examining the implementation of the assistive technology policy and its relationship with learner participation without manipulating the study variables, while combining quantitative measurement with qualitative depth. The study was conducted in Kenya's twelve Special Junior Schools for learners with visual impairment, of which four were selected through cluster sampling: one urban school and three rural schools, to capture diverse educational contexts and resource conditions.

The target population comprised 12 headteachers, 55 teachers and 575 learners with visual impairment across the twelve Special Junior Schools, giving a total target population of 642. Applying Yamane's (1967) formula for finite populations at a 5% margin of error yielded a sample size of 246 respondents. Because the number of headteachers and teachers was relatively small, complete enumeration was applied to these two categories, while a proportionate sample of learners with visual impairment was drawn from the selected schools.

Data were collected using structured questionnaires administered to teachers and learners with visual impairment (the learner questionnaire being made available in Braille and large-print formats as appropriate), and an interview schedule administered to headteachers. The Assistive Technology Policy construct was assessed in terms of the provision of assistive devices, specialised classrooms, and access to assistive technologies, rated on five-point Likert scales. Content validity was established through expert review, and a pilot study conducted in a Special Junior School not included in the main study was used to refine the instruments and assess reliability. Cronbach's alpha for the assistive technology policy scale was 0.815, exceeding the recommended threshold of 0.70 and indicating satisfactory internal consistency (Table 1).

Table 1: Reliability of the Assistive Technology Policy Scale

Variable	Number of Items	Cronbach's Alpha
Assistive technology policy	4	0.815
Learner participation	4	0.798

Quantitative data were coded and analysed using the Statistical Package for the Social Sciences (SPSS) through descriptive statistics and binary logistic regression, while qualitative data from headteacher interviews were analysed thematically. Ethical principles governing educational research, including informed consent, anonymity and confidentiality, were observed throughout the study.

5. Results

5.1 Teachers' Views on the Implementation of the Assistive Technology Policy

Teachers were asked to rate, on a five-point scale from Strongly Disagree to Strongly Agree, statements relating to the implementation of the Assistive Technology Policy in their schools (Table 2). The provision of adequate assistive devices to support learner participation recorded a mean of 3.67 (SD = 0.82). The regular maintenance of available devices attained a mean of 4.00 (SD = 0.85). The presence of classrooms specifically designed to meet the learning needs of learners with visual impairment recorded one of the highest mean scores (M = 4.07, SD = 0.70), matched by reliable access to assistive technologies during classroom instruction (M = 4.07, SD = 0.80). The classroom environment's contribution to enhancing participation recorded a mean of 3.93 (SD = 0.80), while learners' ability to use technology effectively during instruction recorded a mean of 3.87 (SD = 0.64). Overall, the Assistive Technology Policy recorded a composite mean of 3.94 (SD = 0.77), indicating a high level of implementation.

Table 2: Teachers' Responses on the Implementation of the Assistive Technology Policy

Statement	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
School provides adequate assistive devices	0	6.7	33.3	46.7	13.2	3.67	.82
Assistive devices are regularly maintained	0	6.7	13.2	53.3	26.7	4.00	.85
Classrooms specially designed for learners' needs	0	0	20.0	53.3	26.7	4.07	.70
Classroom environment enhances participation	0	6.7	13.2	60.0	13.2	3.93	.80
Learners have reliable access to assistive technologies	0	6.7	6.7	60.0	26.7	4.07	.80
Learners use technology effectively in instruction	0	6.7	6.7	80.0	6.7	3.87	.64
Composite score						3.94	.77

5.2 Learners' Views on the Implementation of the Assistive Technology Policy

Learners with visual impairment rated the extent to which assistive technologies supported their participation on a five-point scale from Never to Always (Table 3). The use of assistive devices such as Braille machines, talking software, or magnifiers recorded a mean of 4.31 (SD = 0.93), with 56.3% of learners reporting always using such devices. Teacher support in using assistive technology recorded a mean of 4.47 (SD = 0.79). The functioning of assistive devices during schoolwork recorded the highest mean score (M = 4.49, SD = 0.82), and the extent to which assistive technology helped learners take part in learning activities recorded a mean of 4.43 (SD = 0.98). Overall, learners' composite rating of the Assistive Technology Policy was 4.43 (SD = 0.88), indicating a very high level of implementation.

Table 3: Learners' Responses on the Implementation of the Assistive Technology Policy

Statement	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	Always (%)	Mean	SD
I use assistive devices (Braille machines, talking software, magnifiers)	1.5	2.0	16.8	23.4	56.3	4.31	.93
Teachers help me when using assistive technology	1.0	1.0	9.6	26.4	61.9	4.47	.79
Assistive devices work well for me in schoolwork	0	3.6	10.2	19.3	67.0	4.49	.82
Assistive technology helps me take part in learning activities	1.0	7.1	8.1	15.2	68.5	4.43	.98
Composite score						4.43	.88

5.3 Headteachers' Qualitative Accounts

Interviews with headteachers provided contextual depth to the quantitative findings. Respondents reported that their schools had embraced a wide range of assistive technologies, including Braille machines, Orbit Readers, Victor Readers, embossers, slates and styluses, tactile laptops, and speech synthesisers, described as essential instructional tools that enabled learners to access information, complete academic tasks, and participate effectively in classroom activities.

> *"The Orbit Reader is available and enables learners to store and retrieve information."* (HT1)

> *"Schools provide Braille machines, Victor Readers, Orbit Readers, and tactile laptops equipped with speech synthesizers."* (HT3)

Respondents further indicated that learners were introduced to assistive technologies from the early stages of schooling and gradually acquired the skills required for their effective use, a progressive approach reported to enhance learners' confidence, independence, and participation in classroom learning. Specialised classrooms, adequate storage facilities for Braille materials, and learner-friendly infrastructure were identified as important factors that supported the effective use of these technologies and, in turn, reduced barriers that might otherwise limit participation.

These qualitative accounts corroborated the quantitative findings from teachers (M = 3.94) and learners (M = 4.43), which indicated high and very high levels of implementation, respectively, underscoring the critical role of assistive technologies in facilitating learner participation among learners with visual impairment in Special Junior Schools in Kenya.

5.4 Hypothesis Testing

The null hypothesis, that there is no statistically significant relationship between the implementation of the assistive technology policy and learner participation among learners with visual impairment in Special Junior Schools in Kenya, was tested using binary logistic regression. The omnibus test of model coefficients was statistically significant, $\chi^2(1) = 71.979$, $p < .001$, indicating that assistive technology policy implementation significantly predicted learner participation. The model explained between 30.6% (Cox and Snell R^2) and 46.2% (Nagelkerke R^2) of the variation in learner participation, and the Hosmer-Lemeshow test, $\chi^2(4) = 0.716$, $p = .949$, indicated that the model fitted the data very well.

Table 4: Binary Logistic Regression – Assistive Technology Policy and Learner Participation

Predictor	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI
Assistive technology policy	2.341	.364	41.333	1	.000	10.388	5.089–21.206
Constant	-8.917	1.578	31.917	1	.000	.000	—

The regression coefficient for assistive technology policy was positive and statistically significant (B = 2.341, SE = 0.364, Wald = 41.333, $p < .001$). The odds ratio, Exp(B) = 10.388, indicated that a one-unit increase in the implementation of the assistive technology policy increased the odds of high learner participation by approximately 10.4 times, with a 95% confidence interval of 5.089 to 21.206. On this basis, the null hypothesis was rejected, confirming a statistically significant relationship between assistive technology policy implementation and learner participation.

The relationship remained significant when assistive technology policy was entered alongside funding, environmental safety, National Curriculum, and staffing policies in a combined binary logistic regression model, $\chi^2(5) = 117.208$, $p < .001$, Nagelkerke $R^2 = .677$. Collinearity diagnostics confirmed no material multicollinearity among the predictors (tolerance for assistive technology = 0.509, VIF = 1.964). In this combined model, assistive technology policy retained a positive and significant coefficient (B = 1.644, Wald = 12.530, $p < .001$; Exp(B) = 5.174), indicating that a one-unit increase in its implementation increased the odds of high learner participation by approximately 5.2 times, net of the other four policy domains. Among the five policy predictors, assistive technology policy ranked second in strength of association, behind only staffing policy, underscoring its position as one of the most powerful determinants of learner participation examined in the study.

6. Discussion

The finding that assistive technology policy implementation was a strong, statistically significant predictor of learner participation corroborates evidence that specialised learning resources and learner support services enhance participation in classroom activities, social interactions, and academic engagement among learners with disabilities

(Ndung'u, 2021). It is also consistent with evidence that assistive technologies substantially improve access to curriculum content and communication (Tripathi & Thakkar, 2025), and with the position that specialised equipment and assistive technologies promote learner independence and meaningful participation (Chivandire & Vincent, 2021); the present study's qualitative findings, that learners were introduced to assistive technologies from early schooling and progressively developed competence in their use, closely mirror this latter argument.

The generally high levels of availability and utilisation reported in this study contrast with several African and Kenyan studies that identified more substantial gaps. Research on public secondary schools in Tharaka Nithi County found that inadequate assistive resources limited participation among learners with low vision (Njeru *et al.*, 2024); a study in Siaya County reported limited integration of assistive technologies in Mathematics instruction (Onyancha, 2020); research in Turkana County documented shortages of assistive audio-visual technologies and limited awareness of their use (Ejore, 2019); and a study covering Meru and Tharaka Nithi counties found that assistive technologies were often limited in number, poorly maintained, and inadequately integrated into teaching (Murithi, 2022). These divergences likely reflect the specialised mandate of Special Junior Schools, which are established specifically to serve learners with visual impairment and may therefore receive more consistent investment in assistive devices than mainstream or more generally inclusive schools, a pattern consistent with earlier evidence that Botswana's progress toward inclusive education has still been constrained by inadequate assistive technology provision in less specialised settings (Mukhopadhyay *et al.*, 2021).

Interpreted through Bronfenbrenner's Ecological Systems Theory, the findings illustrate how assistive technologies operate within the learner's immediate microsystem, directly shaping interactions with teachers, peers and instructional materials, while procurement, maintenance and financial decisions taken at the ecosystem level, themselves shaped by macrosystem-level national policy on inclusive education, determine whether these technologies are available and functional in the first place. The particularly large odds ratio observed for assistive technology policy, both alone and within the combined model, suggests that of the five policy domains examined, this is one whose implementation translates most directly into observable gains in classroom-level participation.

7. Conclusion and Recommendations

The study concludes that the Assistive Technology Policy is a critical determinant of learner participation among learners with visual impairment in Special Junior Schools in Kenya. The availability and effective utilisation of assistive technologies, including Braille machines, Orbit Readers, embossers, Victor Readers, screen readers, magnification devices, and tactile laptops, significantly enhanced learners' ability to

access information, participate in classroom instruction, complete academic tasks, and learn independently. These findings demonstrate that sustained investment in assistive technologies is essential for promoting equitable access to education and meaningful learner participation among learners with visual impairment.

Arising from these findings, the study recommends that the government, school management, and development partners prioritise the procurement, maintenance, upgrading, and equitable distribution of assistive technologies used by learners with visual impairment, including Braille machines, Orbit Readers, embossers, Victor Readers, screen readers, magnification devices, tactile laptops, refreshable Braille displays, and other emerging assistive technologies. Teachers, learners, and support staff should receive continuous training on the effective utilisation and maintenance of these technologies to maximise their contribution to learner participation, academic achievement, and independent learning. More broadly, the Ministry of Education should embed assistive technology provision within an integrated policy implementation framework that coordinates it with funding, environmental safety, curriculum adaptation, and staffing interventions, supported by measurable performance indicators, regular monitoring, and periodic policy review, so as to maximise the collective contribution of these policy dimensions to learner participation.

Future research could usefully track cohorts of learners over time to establish how sustained access to assistive technologies, combined with teacher competence in their use, translates into longer-term gains in academic achievement and post-school transitions, and could compare Special Junior Schools with more generally inclusive settings to clarify the extent to which specialised institutional mandates account for the comparatively high levels of assistive technology implementation observed in this study.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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