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Availability and helpfulness of low vision assistive devices for low vision learners attending inclusive schools in Kakamega County, Kenya

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ABSTRACT

BACKGROUND: Low-vision assistive devices play an essential role in improving the reading performance and quality of life of low-vision children.
MATERIAL AND METHODS: A school-based observational cross-sectional study design was employed based on a census survey that identified 21 low-vision learners who had been assessed and placed in 11 primary public inclusive schools in Kakamega County, of whom 19 consented to participate in this study. Participants responded to the LV Prasad Functional Vision Questionnaire, which elicited how their vision influenced their ease of functioning in day-to-day activities. Data was analyzed using SPSS version 25 software for descriptive and inferential statistics.
RESULTS: The majority (63.2%) of learners did not have assistive devices, which may have resulted in the participants' poor performance in daily living activities. Available assistive devices included spectacle magnifiers (15.8%), dome magnifiers (5.3%), telescopes (5.3%), and spectacles (5.3%). One learner (5.3%) reported the use of multiple assistive devices. Only one learner (5.3%) reported that their assistive device served them perfectly well. The rest, 15.9%, reported that the devices served them reasonably well, 10.5% reported a little, and 5.3% reported that the device was not helping them.
CONCLUSIONS: The findings of this study highlight the lack of assistive devices as a critical barrier to the effective implementation of the inclusive learning system in Kenya. Most low-vision learners attending inclusive schools in Kakamega County did not use any assistive devices, and of the few who did use them, most reported that the devices did not serve them well.

KEY WORDS: low vision; inclusive schools; low-vision assistive devices; low-vision learners

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INTRODUCTION

Low vision forms part of visual impairment. It is defined as patients with a visual acuity of less than 6/18 to 3/60 in the better eye or a visual field of less than 10 degrees from the point of fixation after best correction with spectacles or medication [1]. Studies have established that low vision lowers the quality of life of the affected patients [2].

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Furthermore, visual loss has an economic impact on the lives of the affected individuals, their families, and society in general [3]. Low vision affects not only the family in terms of their role towards the affected person but also their psychological state of mind, where they have to adjust their lives to fit the responsibilities of taking care of a low-vision family member [4].

Rehabilitation services and the administration of assistive devices improve the quality of life of low-vision patients [5]. These services improve the visual and social functioning of the low-vision patient [6]. The provision of low-vision services also results in patient satisfaction [7] and improves the quality of life of low-vision patients [8]. Proper training of low-vision patients in rehabilitative services that come with technology changes is essential to enhance their adaptation [9].

Low-vision optical devices and rehabilitation services have brought about a remarkable improvement in the reading performance of low-vision learners [10]. There has also been a vast improvement in low-vision patients' visual and social functioning by using optical low-vision assistive devices [6]. While providing these devices is helpful, assessing their effectiveness in serving the purpose for which they were meant is very important [11]. Despite the considerable benefit that comes with the use of low-vision services, these services are underutilized in developing countries, especially among older people and women [12]. In schools, the underutilization of low-vision devices is mainly caused by a lack of knowledge on how to use these devices and a lack of follow-up by eye-care practitioners to check on the suitability of the devices [13].

Integration of low-vision services into other disciplines increases the quality of life of low-vision patients [14]. Occupational therapy plays an important role in rehabilitating low-vision patients [15]. The provision of visual aids significantly increases the reading speed of low-vision children [16]. This highlights the importance of providing low-vision devices to low-vision learners while integrating into mainstream schools. Low vision care improves the reading performance of children with multiple disabilities [10]. The use of low-vision assistive devices enhances the quality of life of children with visual impairment [6]. Optical devices also positively improve the quality of life of children with low vision [17, 18]. Low-vision devices provide good rehabilitation for low-vision patients, thus improving their quality of life [19]. Patients undertaking rehabilitation services have experienced improved visual function, patient satisfaction, and a higher quality of life.2 However, some low-vision patients need help understanding what the Low Vision Assistive Devices (LVAD) do in helping them and would not like to identify with vision loss [20]. Therefore, it is important that low vision patients undergo guidance and counseling to accept their condition and the management required.

Patients with low vision with defective colour vision can benefit from glasses with red, amber, and green strips for recognition of traffic light signals and glasses with red, blue, and green strips for desktop colour differentiation [21]. Software development has also made learning more accessible for low-vision and blind learners [22]. Technology has made it possible to convert input from the keyboard to braille and even translate it into Arabic language [23]. Low-vision and blind learners enjoy learning to draw, write, and sign using a computer [24]. However, these strategies usually allow learners to utilize other senses and not exercise their sense of sight. For learners, optical assistive devices like hand-held magnifiers yield great results when used after the learners have undergone training for the same [25]. This implies that the provision of optical devices without proper user training may not be adequate.

While many factors have been identified as hindering the placement of disabled learners, including visually impaired learners, into mainstream schools, the visual performance aspect of it has been underexplored. More emphasis has been placed on assessing the psycho-social aspects of life. Most causes of dropouts include stigmatization, inappropriate curricula, poorly equipped educational institutions, and insufficiently trained teachers [26–28].

There are also barriers to provision of these low vision services such as unawareness, lack of training and unavailability of the devices themselves [29]. There is thus a need to measure the effectiveness of each assistive device that is given to low-vision patients [11], and this aspect is particularly important since visual performance in regard to tasks being undertaken by low-vision learners differs significantly, and their needs vary widely from one person to another.

As a result of these challenges identified by the researcher, this study sought to evaluate the availability and use of assistive devices for low-vision learners in inclusive schools. The rationale is that the lack of such devices could lead to the learners' inability to

undertake vision-demand tasks at school, hindering the successful implementation of inclusive education. As a result, learners could possibly drop out of school.

MATERIAL AND METHODS

Study design

This study employed a school-based observational cross-sectional study design.

Setting and study population

The study was conducted in public primary inclusive schools that host low-vision learners in Kakamega County, Kenya. Most low-vision learners attend special schools for the visually impaired. All the low-vision learners in inclusive schools in Kakamega County, aged 10 to 21 years, formed the study population for this research (visual acuity of less than 6/18 in the better eye up to 3/60 or a visual field of less than 10 degrees from the point of fixation after best correction). Out of the 76 inclusive schools in which visually impaired learners are hosted in Kakamega County, there are 11 schools in which the County Educational Assessment and Resource Center places typical low-vision learners.

Learners with multiple disabilities were excluded from the study. This is because some disabilities, like autism, affect the learners' cognitive reasoning and independent response and could affect how they respond to the Functional Vision Assessment Questionnaire. Low-vision learners under 10 were also excluded from this study because they would not be able to respond effectively to the questionnaire. Furthermore, learners whose parents didn't give their permission or consent and learners with incomplete questionnaires were excluded from this study.

Data collection

Before data collection, permission was sought from the heads of the schools where the study was conducted. Prior to data collection, an informed consent form was administered to the low-vision learners who were above 18 years old. Similarly, guardians of learners who were below eighteen years of age were given the same forms to sign on their behalf. Visual acuity was assessed to classify the participants as per the World Health Organization (WHO) classification of low vision.

The Low Vision Prasad Functional Vision Assessment (FVA) questionnaire was adopted and administered to the learners before other clinical tests were conducted. The researcher guided the learners in completing the questionnaire and allowed them to make their own decisions. The available low-vision assistive devices were checked and classified as optical or non-optical devices and as per the tasks for which they were relevant. This was recorded against the actual tasks for which the low-vision learners were using the devices and compared to see whether the available devices were being used for the appropriate tasks. Learners who were using low vision devices were asked to demonstrate how they used these devices and hence assessed on whether or not the devices were being used in the correct manner. Learners were further asked to report whether or not the assistive devices were serving them sufficiently well.

Data analysis

The data collected for the research was captured in Microsoft Excel, edited, and coded. Subsequently, the cleaned and verified data was transferred into the Statistical Package for the Social Sciences (SPSS) (version 25) software. Dependent and independent variables were derived, and data was analyzed using descriptive and inferential statistics as well as percentages. The data was presented using bar graphs and charts.

Ethical considerations

Ethical approval to conduct the research was obtained from the Institutional Review and Ethics Committee (IREC) of Masinde Muliro University of Science and Technology (MMUST/IERC/113/2020). Furthermore, a research permit was obtained from the National Commission of Science and Technology (NACOSTI) (Reference number: 523567). The researcher adhered to all the ethical protocols established by the institution, and all data obtained was protected on a password-controlled computer so that only the researcher would have access to it. Data was stored as per the university archiving policy.

RESULTS

Demographic profile of respondents

There were 13 male (68.4%) and 6 female (31.6%) low-vision learners, indicating an unequal gender distribution of low-vision learners attending Kakamega County inclusive schools. The age of the low-vision learners ranged from 10 to 21 years old. The highest number of learners was in

the 13-year age group, while the mean age was 14.47 years, with a standard deviation of 3.04 years. The results showed a normal distribution curve across age where the least numbers were recorded at the tail ends of 10 years and 21 years of age. The highest number of low-vision learners — 6 (31.6%) — was in grade eight, while the lowest was 1 (5.3%) in grades two and three each. All grades from two to eight were represented in this study. Most learners (57.9%) were unsure of the duration for which they have been low-vision patients, while the rest (42.1%) recorded a period of five to 16 years of visual impairment (Tab. 1)

Table 1. The demographics of children with low vision in inclusive schools

Variables	n = 19	%
Sex		
Male	13	68.4
Female	6	31.6
Age		
10	1	5.3
11	2	10.5
12	1	5.3
13	6	31.6
14	2	10.5
15	1	5.3
16	1	5.3
18	3	15.8
19	1	5.3
21	1	5.3
Grade		
2	1	5.3
3	1	5.3
4	2	10.5
5	3	15.8
6	2	10.5
7	4	21.1
8	6	31.6
Duration of impairment [years]		
11	1	5.3
13	2	10.5
14	1	5.3
15	1	5.3
16	1	5.3
5	1	5.3
6	1	5.3
Not sure	11	57.9

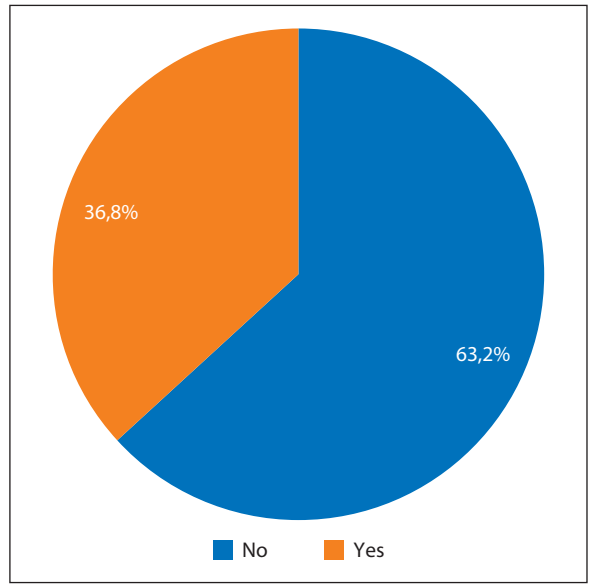

FIGURE 1. The use assistive devices by low-vision learners

The use of assistive devices by low-vision learners

More than half of the learners (63.2%) did not use assistive devices, while only 36.8% used assistive devices. Only 7 out of 19 low-vision learners used assistive devices (Fig. 1).

Type of low-vision devices used by the learners in inclusive school

The researcher assessed the low-vision devices learners use in inclusive schools. The most commonly used device was the spectacle magnifier (15.8%), while the other types of assistive devices represented 5.3% of the total participants using assistive devices. The results are represented in Table 2.

Helpfulness of assistive devices to learners with low vision

Of the learners who use assistive devices, 15.80% reported that the devices were helping them reasonably well, 10.5% reported helping them a little, and 5.3% reported helping very well. However, 5.30% reported that they were not helping them at all. These results and the fact that 63.2% of learners did not use assistive highlights suggest the need to provide the appropriate assistive devices to address the purpose for which each is meant (Fig. 2).

Barriers to the use of assistive devices by learners with low vision in inclusive schools

Learners not using low-vision assistive devices highlighted various challenges to acquiring these

Table 2. Type of low vision devices used by the learners in inclusive school			
	Response	**n**	**%**
Type of low vision assistive devices used by the low vision learners	A dome magnifier	1	5.3
	Not applicable	12	63.2
	Spectacle Magnifier	3	15.8
	Spectacle Magnifier, Telescope and Reading stand	1	5.3
	Spectacles	1	5.3
	Telescope	1	5.3
	Total	19	100

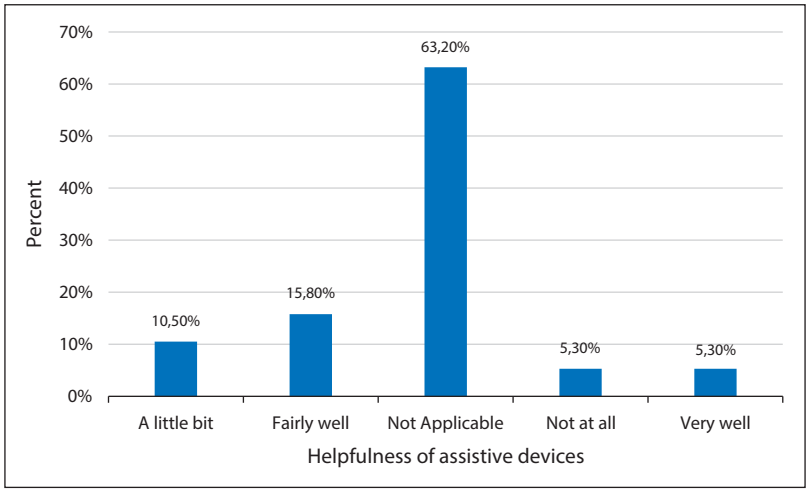

FIGURE 2. **Helpfulness [?]** of assistive devices to learners with low vision

Table 3. Barriers to the use of assistive devices by learners with low vision in inclusive schools			
	Response	**n**	**%**
Barriers to use of assistive devices	High cost	2	10.5
	Inaccessibility	3	15.8
	Lack of awareness	2	10.6
	Not applicable to me	7	36.8
	Never visited an eye hospital	3	15.8
	Was told he doesn't need devices	2	10.5

devices, as shown in Table 3. These included high cost (10.5%), inaccessibility (15.8%), lack of awareness (10.6%), never visiting an eye hospital (15.8%), and failure to be guided on the need for the devices (10.5%). The remaining 36.8% of learners were already using assistive devices.

Association between demographics characteristics and use of assistive devices

The Pearson chi-square test was performed to determine if age, gender, grade, and duration of impairment were associated with the use of assistive devices among learners. The results showed that none of the demographic variables had a significant association with the use of assistive devices ($p > 0.05$) (Tab. 4).

DISCUSSION

Demographic profile of respondents

There were more male than female low-vision learners attending inclusive school systems in

Table 4. Association between demographics characteristics and use of assistive devices

Demographics	Chi-square value	Significance level
Age	8.26	0.509
Gender	0.046	0.682
Grade	3.96	0.829
Duration of impairment (years)	7.27	0.400

*Dependent variable: Use of assistive devices

Kakamega County. This result contradicts research undertaken in Asia, Africa, and Latin America, showing that low vision was more prevalent in girls than boys [30]. Further research would need to be undertaken to determine whether this finding applies to the entire Kenya and, more broadly, to the African continent. There were more low-vision learners in grade eight, the highest grade in the Kenyan Primary school system, compared to the lower grades. Studies have not identified the relationship between low vision and grade or level of education. This fact could be attributed to the challenges with inclusive learning in Kenya, which may affect learners in the lower grades more than those in the upper grades and likely result in school dropouts. The majority of the low-vision learners were unaware of when they became visually impaired, but 42.1% indicated that they had been impaired for a period of between 5 and 16 years.

The use of assistive devices

This study found that only 36.8% of the low-vision learners attending the inclusive school systems in Kakamega County have acquired low-vision assistive devices. In comparison, 63.2% do not use any low-vision assistive device. This is a serious concern since it has been established that the provision of low-vision services and devices dramatically increases the quality of life of low-vision patients [2]. The provision of low-vision assistive devices also enables low-vision learners to utilize their residual vision so that they don't have to learn braille necessarily [31]. Furthermore, low-vision assistive devices improve reading rehabilitation in low-vision patients [19], and their reading performance increases with magnification [6, 10, 32]. That means that by failing to obtain access to low-vision assistive devices, the quality of life of these learners is significantly decreased. Some of the barriers to the uptake of these devices, which were identified in this study, included the high cost of the devices, inaccessibility to the eye clinic, and unawareness of the availability of the devices. These findings are very similar to those reported in a previous study performed in India, which established that the barriers to the uptake of low-vision services were unawareness, lack of training, and unavailability of the devices themselves [29]. Although studies have presented the challenges facing implementing inclusive school systems [26, 27, 29], there was a shortage of data addressing the barriers to the uptake of low-vision assistive devices by low-vision learners in inclusive schools in Kenya. These barriers are very synonymous with what other studies have presented in the past.

Type and helpfulness of low vision assistive devices

The type of devices used by the low vision learners included mostly spectacle magnifiers. This could be attributed to the fact that head-mounted assistive devices like spectacle magnifiers yield better results in improving visual ability and face recognition [33] while leaving the hands free to work. Other devices included telescopes and dome magnifiers. Most learners reported some deficiency in the effectiveness of the assistive devices, while only 5.3% reported that the device was serving them perfectly well. These results agree with Jutai et al., who cited the importance of assessing the effectiveness of assistive devices to ensure they effectively serve the purpose they are meant for [11]. These findings imply that most low-vision assistive devices do not correctly serve the visual demands. For instance, some learners only use telescopes to improve distance tasks but not near tasks [34]. As a result, these learners are still likely to perform poorly in near tasks such as reading and writing despite having assistive devices. It has further been elicited that dome-shaped magnifiers do better than cylindrical-shaped magnifiers and should preferably be administered to visually impaired children [35], yet only one low-vision learner in this study was using a dome magnifier. Stand magnifiers have been commented on as being efficient for use by low-vision children [36]. However, most learners in this study did not use stand magnifiers.

CONCLUSION

A key finding from this study's findings was that most low-vision learners attending inclusive

schools in Kakamega County did not use any assistive devices. Of the few who used them, most reported that the devices were not serving them well. There is a need to prioritize fund allocation to providing optical and non-optical low-vision assistive devices for low-vision learners attending inclusive schools. Increasing funding would lead to more effective learning and academic excellence for low-vision learners. This, in turn, would lead to better socio-economical activities and likely successful employment and productivity.

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Conflict of interests

The authors declare that no personal or financial interests influenced the writing of this article.

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