



AMERICAN JOURNAL OF INTERDISCIPLINARY RESEARCH AND INNOVATION (AJIRI)

ISSN: 2833-2237 (ONLINE)

VOLUME 2 ISSUE 4 (2023)

**PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA**

Assistive Technologies and Participation of Students with Visual Impairments in ExtraCurricular Activities: What Does the Literature Say?

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Article Information

Received: October 03, 2023

Accepted: November 05, 2023

Published: November 09, 2023

Keywords

*Assistive Technology Devices,
Extracurricular Activities,
Visual Impairment*

ABSTRACT

The rapid growth of technological advancement has impacted teaching and learning at all levels of education. Like all other students, visually challenged students need information and communication technologies to bridge the gap from classroom learning to extracurricular activities (indoor and outdoor learning activities). Therefore, this study conducted an empirical literature review on how assistive technology devices enhance participation of students with visual impairments (SVI) in extracurricular activities (ECA). The study utilized peer-reviewed and scholarly articles that provided relevant insights regarding assistive technologies and participation of SVI in ECA. The review found that assistive technologies play a great role in enhancing participation of SVI in ECA including provision of access to information and materials, navigation and mobility support, communication and social interaction, skill development and educational opportunities. The review also revealed challenges associated with the use of AT in participation of SVI in ECA that included lack of accessibility standards, limited availability and affordability, technological compatibility, and inadequate training and technical support. The review concludes that assistive technologies play a crucial role in enhancing participation of students with VI in ECA and that these students are prepared for better future roles as adults. It also calls for stakeholders to create more inclusive and equitable extracurricular environment through addressing the barriers that hinder SVI to participate in ECA.

INTRODUCTION

Technological advancement has caused substantial improvements in various sectors including education, the extent that all learners regardless of their backgrounds, abilities and disabilities can access education. Assistive devices in particular enable students with disabilities to access both curricular and extracurricular knowledge and skills offered in schools for their daily lives (Gierrach & Stindt, 2009). These technologies have enabled the participation of pupils and students with VI in both curricular and extracurricular activities in schools and enhance learning and ability for self-expression and communication (Kisanga & Kisanga, 2020). They also equip teachers with innovative tools to manage barriers that limit the process of learning of students with VI (Oira, 2016) and help students improve their scientific literacy which is the basis of obtaining ICT skills (Natividad & Abrogena, 2023). In this paper, assistive technologies are conceived as per various scholars. Some scholars consider them as tools, equipment and services used to improve the functionalities of those with disabilities (Winter & O'Raw, 2010). More so, assistive technologies are defined as the devices that help people with disabilities and those with special educational needs to better function in their daily lives and as they interact with the society, to attain better quality of life, and achieve their fullest potentials (Lancioni *et al.*, 2013). On the other hand, extracurricular activities are educational activities that do not fall within the scope of the regular curriculum (WordWeb, 2020); they are school-based activities performed by students

outside the realm of the normal curriculum of a school. These extracurricular activities are available to learners of various levels of education from primary school level to higher learning institutions, and thus, diverse learners including those with visual impairments in all these levels are expected to participate. Learners in primary schools including those with visual impairments benefit from extracurricular activities. ECA play a crucial role in their overall development as these activities provide them with opportunities for social interaction, skill-building, and personal growth. Inclusive extracurricular programs can ensure that students with visual impairments have equal access to these benefits. According to Wilson and Williams (2019), inclusive extracurricular activities for students with visual impairments should be designed with careful consideration of their unique needs. Designing ECA may involve making modifications to the activities, providing appropriate accommodations, and ensuring that adequate support is available. For instance, sports activities can be adapted using specialized equipment such as audible balls or modified playing fields to facilitate the participation of visually impaired students (Wilson & Williams, 2019). Furthermore, braille clubs and tactile art classes can be offered to promote literacy and artistic expression for students with visual impairments (Wilson & Williams, 2019). These activities not only provide opportunities for learning and creativity but also foster a sense of belonging and self-confidence among visually impaired students. In a study conducted by Johnson *et al.*, (2021), it was found that participation in extracurricular activities

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had a positive impact on the social and emotional well-being of learners with visual impairments in primary school. The study highlighted the importance of creating a supportive and inclusive environment within extracurricular programs, where visually impaired learners can interact with their peers and develop meaningful relationships. Also, extracurricular activities continue to play a significant role in the development and well-being of students in secondary schools, including those with visual impairments. These activities provide opportunities for social engagement, skill development, and personal growth, promoting inclusivity and fostering a sense of belonging. According to James and Anderson (2020), inclusive extracurricular programs in secondary schools should consider the specific needs of students with visual impairments. Adaptations and accommodations may be necessary to ensure equal participation and accessibility. For example, in sports activities, modifications such as the use of goalball, a sport designed for individuals with visual impairments, or the implementation of audio cues can enable visually impaired students to actively participate (James & Anderson, 2020). In addition to sports, various other extracurricular activities can be tailored to meet the needs of visually impaired students in secondary schools. For instance, music programs can provide opportunities for students to explore and develop their auditory and musical abilities, while drama clubs can incorporate techniques such as audio description to make performances inclusive for individuals with visual impairments (James & Anderson, 2020). A study by Roberts *et al.* (2022) examined the impact of inclusive extracurricular activities on the academic performance and social integration of secondary school students with visual impairments. The findings revealed that participation in extracurricular activities positively correlated with improved academic outcomes and enhanced social connections among visually impaired students. The study emphasized the importance of creating a supportive and inclusive environment within extracurricular programs to facilitate the engagement and success of visually impaired students.

Moreover, extracurricular activities play a vital role in the holistic development of students including those with visual impairments in colleges and higher learning institutions. While it is crucial to ensure equal opportunities for all students, including those with visual impairments, some adaptations and accommodations may be necessary to facilitate their active participation in extracurricular activities. Some examples of extracurricular activities and approaches that have been implemented to support students with visual impairments in colleges and higher learning institutions include the following: Adapted sports programs; adapted sports programs provide inclusive opportunities for students with visual impairments to engage in physical activities. These programs may include sports such as goalball, blind soccer, or tandem cycling, which have been modified to suit the needs of visually impaired participants (Pereira, 2018). Accessible

performing arts; colleges and higher learning institutions have worked towards making performing arts activities accessible to students with visual impairments. Provision of this access may involve providing audio descriptions during theatrical performances or offering tactile experiences for visually impaired students to explore stage props and costumes (Miller, 2019). Assistive technology and study tools; the use of these tools can enhance the participation of visually impaired students in extracurricular activities. Screen readers, braille displays, and accessible e-books are examples of tools that can assist students with visual impairments in accessing materials relevant to their extracurricular interests (Neely, 2020). Student organizations and clubs; colleges and higher learning institutions often have student organizations and clubs that cater to diverse interests. These organizations can create inclusive environments by considering the needs of visually impaired students. For example, audio descriptions can be provided during club events or meetings to ensure that visually impaired students have equal access to information (Matsuba & Vanderheiden, 2018). Colleges and higher learning institutions need to ensure that policies, facilities, and support services are in place to enable visually impaired students to actively participate in extracurricular activities. By fostering inclusivity and providing necessary accommodations, these institutions can create a more equitable and enriching experience for all students.

In Tanzania, efforts have been made to promote inclusive education and support students with visual impairments in both academic and extracurricular activities. While specific information on extracurricular activities for visually impaired students in Tanzania is limited, the following strategies are commonly implemented to ensure inclusion. Special education units; Tanzanian schools and higher education institutions often have special education units or resource centres that cater to the needs of students with visual impairments. These units provide specialized support, including assistive devices, materials in accessible formats (such as Braille or large print), and trained staff to facilitate the participation of visually impaired students in various activities (Bonga, 2016). Braille instruction; braille instruction plays a crucial role in enabling visually impaired students to access written information. In Tanzania, efforts have been made to provide braille instruction to visually impaired students, allowing them to participate in extracurricular activities that involve reading or writing (Eze, 2018). Orientation and mobility training; orientation and mobility training are essential for visually impaired students to navigate their physical environment independently. By developing skills such as cane usage, spatial orientation, and independent travel, visually impaired students can actively engage in extracurricular activities that take place both within and outside the school premises (Mallya, 2018). Collaboration with disability organizations; collaboration between schools and disability organizations in Tanzania can enhance the provision of extracurricular activities

for visually impaired students. These organizations often have expertise in adaptive sports, arts programs, and other recreational activities suitable for visually impaired individuals. Partnering with such organizations can help create opportunities for visually impaired students to participate in inclusive extracurricular activities (United Nations, 2021). While specific research on the implementation and impact of extracurricular activities for visually impaired students in Tanzania are limited, it is important to recognize that inclusive education practices and efforts are being made to support their participation. Collaboration among schools, special education units, disability organizations, and the government can contribute to fostering inclusive environments and expanding opportunities for extracurricular engagement among visually impaired students in Tanzania. Like all other students, those with visual impairments need to participate in both curricular such as attending classes, performing class assignments and examinations and extracurricular activities such as sports and games, cultural groups, prosocial groups, cleanliness in the school surroundings and other extracurricular activities (Hossan, 2019). However, their participation in ECA is limited, because teachers mainly focus on curricular activities due to different reasons including overprotection and teachers' negative perception on the capabilities of individuals with visual impairments (Kisanga, 2017).

Participation in extracurricular activities can have significant benefits for the personality of students with visual impairments and educational wise. Students with VI can participate in various extracurricular activities including sports and games, environmental cleanliness, and club activities (Anselimus, 2023). Scholars have shown that these activities serve several benefits to students with VI including but not limited to the following; first, social integration and peer relationships, as ECA provides them with opportunities for social integration and cultivates their social skills. Also, being involved in group activities fosters a sense of belonging, promotes teamwork, and facilitates the formation of friendships and social connections (Rodriguez-Gil *et al.*, 2019; Macaro *et al.*, 2021). Second, personal development of students with visual impairments; through participation in ECA they gain confidence, develop self-advocacy skills, and build resilience. Taking part in activities outside of the academic realm allows students to explore their interests, discover their strengths, and develop a sense of identity and purpose which contributes to the overall well-being and life satisfaction of students with visual impairments. Engaging in activities they enjoy enhances their overall quality of life and fosters a sense of personal fulfillment and provides them with a platform for self-expression, personal growth, and a sense of accomplishment (Lewis & Watson, 2020; Shapiro & Johnson, 2020; Macaro *et al.*, 2021). Third, extracurricular involvement provides enhanced communication and social skills; participating in extracurricular activities offers students with visual impairments opportunities to

improve their communication and social skills. Engaging in group activities necessitates effective communication, collaboration, and negotiation with peers both at school and home settings (Rodriguez-Gil *et al.*, 2019). Through regular interaction, students can refine their verbal and non-verbal communication abilities, strengthen their social competencies, and acquire vital life skills that are crucial to their communication with their fellows at school, teachers and parents, and helps them expand their networks of people. Fourth, improved academic performance; research suggests that involvement in extracurricular activities can positively impact academic performance for students with visual impairments. Engaging in diverse activities cultivates a sense of discipline, time management, and organization (Shapiro & Johnson, 2020). Students' discipline further helps them to actively make follow ups on and participate in the school tasks provided by their teachers, time management enables them to accomplish the academic tasks within the timeframe provided in a very organized manner. Students who participate in extracurricular activities often exhibit higher levels of motivation, better attendance rates, and improved academic outcomes (Lewis & Watson, 2020). Fifth, expanded career opportunities; participation in extracurricular activities can broaden the career prospects of students with visual impairments. Involvement in activities such as robotics, coding, or performing arts can nurture skills and interests that align with various professional paths (Shapiro & Johnson, 2020). Additionally, participation demonstrates initiative, commitment, and a willingness to engage beyond academic requirements, which can be valuable in college applications and future employment endeavours.

There are limited studies in Tanzania regarding participation of students with visual impairments in extracurricular activities, the available have shown that students with VI especially those in special schools participate in few extracurricular activities and that teachers focus much on planning for curricular than extracurricular activities for students (Anselimus, 2023; Kisanga, 2017). None of the available literature in Tanzania explores on how assistive technologies can be utilized to enhance participation of students with visual impairments in extracurricular activities. This study therefore aimed at reviewing the literature on assistive technologies that enhance the participation of students with visual impairments in extracurricular activities. With this purpose, the study reviews specifically focused on examining the role of assistive technologies in the participation of students with visual impairments in extracurricular activities, and the challenges of assistive technologies in the participation of students with visual impairments in extracurricular activities. From these objectives, two questions to guide the review were developed.

1. What is the role of assistive technologies in the participation of students with VI in extracurricular activities?

2. What are barriers and challenges of assistive technologies in the participation of students with VI in extracurricular activities?

METHODOLOGY

Search Strategy

A comprehensive search was performed across multiple academic databases to ensure a wide coverage of relevant literature. The selected databases included Education Resources Information Center (ERIC), Google Scholar, Research Gate, PsychINFO, and Disability and Rehabilitation. Key words were identified as the main components of the search queries, these included ‘technology’, ‘assistive technology (AT)’, extracurricular activities (ECA), and ‘students with visual impairments

(SVI)’. The separate search queries were constructed using the identified keywords, designed to capture the intersection of these keywords in the context of the research topic. Thus, the following search queries were developed: - ‘technology and extracurricular activities’, ‘assistive technology and extracurricular activities’, ‘assistive technologies and participation of students with disabilities (SWDs) in extracurricular activities’, and lastly ‘assistive technologies and participation of students with visual impairments in extracurricular activities. The constructed search queries were entered into the selected databases’ search interfaces. The searches were restricted to articles published in English and covered the timeframe from the earliest available publication up to the present day. The search results were as indicated in the table below: -

Table 1: Search results of the articles from several databases

Key phases	ERIC	Google Scholar	Research Gate	Psych INFO	Disability & Rehabilitation
Technology and ECA	93	81	104	40	38
AT and ECA	58	60	97	21	18
AT and Participation of SWDs in ECA	12	28	37	16	11
AT and participation of SVI in ECA	4	3	2	0	0
Included articles	5	4	3	1	1

Selection Criteria

The search results were initially screened based on their titles and abstracts to assess their relevance to the research topic. Articles that appeared to be potentially relevant were included for further evaluation. Full texts of the selected articles were obtained and thoroughly evaluated to determine their suitability for inclusion in the literature review. Articles that specifically addressed the relationship between assistive technology, extracurricular activities, and students with visual impairments were included for further analysis. A total of 14 papers and reports were utilized in this review based on the following criteria

First, relevance to the research topic; only articles that directly addressed and provided substantial information related to assistive technologies and participation of students with visual impairments were deemed eligible for this review. Second, alignment with research objectives; only articles that contributed relevant findings, insights, theories, or discussions that aligned with either the role of assistive technology in the participation of students with visual impairments in ECA or the challenges and barriers of assistive technology devices in the participation of students with VI in ECA were included. Third, peer-reviewed and scholarly; preference was given to articles published in reputable peer-reviewed journals, conference proceedings, or scholarly books, as these sources undergo rigorous evaluation by experts in the field. Fourth, publication date range; this literature review specified a particular time frame for the inclusion of articles, which were articles published from 2010 to date. These dates follow the recent advancement of science and technology worldwide, and thus, up-to-date articles were considered

to have more recent and relevant information regarding assistive technologies and the participation of students with visual impairments. Fifth, research design and methodology; depending on the nature of this literature review, articles employing different research designs including empirical studies, case studies, and systematic reviews were included to provide a comprehensive overview of the topic. Articles that did not identify with either of the scholarly design were excluded. Lastly, accessibility and language; articles that are available in full text and written in the English language and understood were included in the review. Articles which were written in languages other than English were excluded; also, literature that demanded high prices to access full texts was excluded from the review.

RESULTS

This literature review sought to answer two research questions; ‘What is the role of assistive technologies in the participation of students with visual impairments in extracurricular activities?’ and ‘What are the barriers and challenges of assistive technologies on the participation of students with visual impairments in extracurricular activities?’ The following were the results from the reviewed literature: -

The Role of Assistive Technologies in the Participation of Students with VI in ECA

The integration of assistive technology devices has shown promise in enhancing the participation of students with visual impairments in extracurricular activities. These devices play a crucial role in improving accessibility,

fostering inclusivity, and facilitating active engagement. Several assistive technologies aid students with VI to comfortably participate in leisure and games including tactile dice, peg boards, audible balls, large print play cards, braille chess, screen readers, braille displays, tactile maps, and audio description systems (Smith *et al.*, 2018; Senjam, 2019). Assistive technologies aid the participation of students with visual impairments in extracurricular activities in several ways as follows:

Access to information and materials; assistive technology devices such as screen readers, braille displays, and tactile maps enable students with visual impairments to access information and materials related to extracurricular activities (Smith *et al.*, 2018). These devices convert visual content into auditory or tactile formats, allowing students to engage with texts, graphics, and other materials (Lewis & Watson, 2020). By providing equal access to information, assistive technology promotes the participation of students with visual impairments in a wide range of activities including sports and games. Navigation and mobility support; assistive technology devices contribute to the navigation and mobility of students with visual impairments during extracurricular activities. Mobile apps with GPS functionality, orientation aids, and navigation systems assist students in independently moving within physical environments (Rodriguez-Gil *et al.*, 2019). Such devices enhance students' spatial awareness, orientation, and mobility, enabling them to actively participate in various activities, including sports and outdoor events. Communication and social interaction; assistive technology devices facilitate communication and social interaction for students with visual impairments, promoting their participation in group activities. Communication apps, accessible gaming interfaces, and social media platforms provide alternative modes of communication and platforms for engaging with peers (Macaro *et al.*, 2021). These devices empower students to express themselves, collaborate, and form social connections, thus fostering their active participation in extracurricular settings. Skill development and educational opportunities; assistive technology devices offer opportunities for skill development and educational growth in extracurricular activities. Adaptive equipment, specialized software, and virtual reality tools enable students to engage in activities such as music, art, and STEM projects (Shapiro & Johnson, 2020). These devices facilitate learning, enhance creativity, and promote skill acquisition, allowing students with visual impairments to actively participate and excel in various extracurricular pursuits. Independence and self-advocacy; assistive technology devices empower students with visual impairments to become more independent and self-advocates in extracurricular activities. By providing access to information, navigation support, and communication tools, these devices enable students to navigate and participate more autonomously (Smith *et al.*, 2018). This increased independence fosters self-confidence, self-

determination, and the ability to advocate for their needs and preferences in extracurricular contexts.

Barriers and Challenges of Assistive Technologies on the Participation

Based on the reviewed literature, several barriers and challenges of assistive technologies on participation of students with visual impairments in extracurricular activities are presented on this section.

Lack of accessibility standards; one of the barriers to the effective use of assistive technologies for students with visual impairments in extracurricular activities is the lack of standardized accessibility guidelines. Without clear standards, there can be inconsistencies in the design and implementation of assistive technologies, making it difficult for students to access and utilize these technologies effectively (Moon & Zhang, 2021). Limited availability and affordability; another challenge is the limited availability and affordability of assistive technologies. Many advanced and specialized assistive technologies are often expensive, making it difficult for schools and students to procure the necessary devices and software (Datta *et al.*, 2018). The lack of financial resources and support can hinder the widespread adoption and use of assistive technologies in extracurricular activities. Technological compatibility and interoperability; achieving seamless integration and compatibility between different assistive technologies can be challenging. Different devices and software may use different platforms or operating systems, leading to compatibility issues (Scherer, 2018). This can hinder the smooth functioning of assistive technologies and limit their effectiveness in supporting students' participation in extracurricular activities. Training and technical support; the successful utilization of assistive technologies requires adequate training and technical support for both students and educators. Lack of training on how to effectively use the technologies, troubleshoot technical issues, and customize the devices to individual needs can impede students' participation in extracurricular activities (Boucenna *et al.*, 2020). Educators may also require ongoing support to stay updated on the latest assistive technologies and their applications. Stigma and social acceptance; students with visual impairments may face social stigma and lack of acceptance when using assistive technologies in extracurricular activities. Negative attitudes from peers or misconceptions about assistive technologies can affect students' confidence and willingness to participate (Abdul Majid *et al.*, 2019). Addressing stigma and fostering a supportive environment is crucial for promoting the inclusion and participation of students with visual impairments. Mitigating the barriers that students with visual impairments face in accessing and utilizing assistive technologies in ECA, it is vital for stakeholders including both governmental and non-governmental organizations, and individuals to provide needed support such as materials and mechanisms to education teachers, students and parents (Flores & Perez, 2022).

Evaluation

The literature review provided a comprehensive overview of the current state of knowledge on the availability and contribution of assistive technologies for students with visual impairments in extracurricular activities. However, most of the sources were based on qualitative studies and descriptive reports, which may not capture the full range or complexity of the experiences and perspectives of students with visual impairments. Moreover, some sources were focused on specific contexts and populations largely Western countries including the United States, the United Kingdom and other European countries, which may limit their generalizability and applicability to Tanzania and other African settings. Therefore, there is a need for more quantitative and comparative studies, and Tanzanian based, that can provide more robust and reliable evidence on the role and challenges of assistive technologies on participation of students with visual impairments in extracurricular activities.

CONCLUSION

Assistive technologies play a crucial role in enhancing successful participation of students with visual impairments in extracurricular activities. These technologies increase accessibility of extracurricular games, plays and other activities, promote skill development among individuals with disabilities, and enhance social inclusion of individuals and students with disabilities. With assistive technologies, students from become independent in many school-based extracurricular activities which is the basis of becoming autonomous and productive citizens later in adulthood. Nevertheless, several barriers continue to impede the full participation of students with visual impairments in extracurricular activities in schools. Through addressing issues related to funding, awareness, accessibility, and attitudes, we can work towards creating a more inclusive and equitable extracurricular environment, where all students, regardless of their visual abilities, can thrive and participate fully in the activities they are passionate about and calls for participation

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