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Digital Assistive Technologies and Their Effectiveness in Supporting Students with Visual Impairments in Online Learning Environments

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Abstract

This research seeks to examine the efficiency of Digital Assistive Technologies (DATs) in assisting the visually impaired students in a learning environment that is online. Twenty visually impaired university students in distance learning programs were used as the sample. The methodology used was descriptive quantitative and involved a structured questionnaire that was aimed at evaluating five different domains, namely the types of DATs used, satisfaction, usability, academic impact, and perceived inclusivity. The data was analyzed with means, standard deviations, and one sample t-tests. The findings indicated that the most used technologies were screen readers (M = 4.10, SD = 0.64) and magnifiers (M = 3.95, SD = 0.89). The students expressed great satisfaction with DATs (M = 3.81, SD = 0.34) and ease of use (M = 3.84, SD = 0.55). The perceived academic performance was also very high, with an increase in speed of assignment completion (M = 3.90, SD = 0.27) and academic performance (M = 3.96, SD = 0.34). Also, the students strongly agreed that DATs improved their educational autonomy (M = 3.88, SD = 0.36) and were important in inclusive education (M = 4.00, SD = 0.30). The mean values of all the significant variables were very high above the neutral score of 3 ($p < .001$), showing that the positive perceptions of DATs in digital learning contexts have been widespread.

Keywords: *Digital Assistive Technologies, Blindness, E-Learning, Inclusive Education, Accessible Education, Screen-Readers, Usability.*

Introduction

The high rate at which digital learning environments have been developing especially due to the COVID-19 pandemic has come with a lot of opportunities and challenges to educational institutions across the world. When universities shifted to online platforms to maintain the flow of education, the accessibility issues rose to a new level among students with disabilities, particularly with visual ones (Khumalo, 2025; Zenda et al., 2024). Even though the use of Information and Communication Technology (ICT) has been promising in terms of democratizing access to education, visually impaired students have experienced immense disparities in their ability to navigate these platforms, which are in many cases compounded by insufficient assistive technology and support services (Chileshe, Annie, & Mundende, 2025; Khumalo, 2025; Talafha & Bataineh, 2025).

The problem of visual impairment, which includes partial visual loss, full blindness, and anything in between, has a major effect on educational opportunities and quality of life (Muradyan, 2023). The world has experienced a visual impairment rate of about 2.2 billion people with varying severity and as a result, special measures must be put in place so that educational experiences become equal (Muradyan, 2023; World Health Organization, 2022). In the case of visually impaired students, white canes and Braille books have offered rudimentary accessibility over time, albeit in the form of conventional assistive technologies. Nevertheless, these tools do not have the flexibility they need to be able to respond to modern digital educational systems (Naayini, Myakala, & Bura, 2025; Muradyan, 2023).

Digital Assistive Technologies (DATs), which include screen readers (e.g., JAWS and NVDA), Braille displays, text-enlargement software, text-to-speech tools, and AI-enabled wearables, are the recent technologies that can greatly improve the learning process of the visually impaired students (Muradyan, 2023; Naayini et al., 2025; Elshaer, AlNajdi, & Salem, 2025). These technologies allow a person to interact with the digital content independently, thereby filling gaps that have been neglected in the past by traditional teaching methods (Naayini et al., 2025; Elshaer et al., 2025). As an example, AI-based gadgets like Microsoft

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Seeing AI and Envision Glasses combine advanced computer vision and Natural Language Processing (NLP) to deliver a real-time object recognition, scene description, and augmented navigation (Naayini et al., 2025).

Although the potential of DATs is encouraging, there have been many obstacles to their successful incorporation and mass use. According to Chileshe et al. (2025), the Zambian visually impaired learners had severe problems, such as poor access to ICT tools, untrained ICT teachers, and institutional support. The same situation in Zimbabwe highlighted the significant absence of proper assistive technologies and limited institutional support of visually impaired university students, which excludes them in any significant part of online learning environments (Khumalo, 2025).

A study by Elshemy et al. (2025) emphasizes that technological innovation is not the only factor that will determine the overall success of the DATs since the implementation requires the development of effective rehabilitative training programs that will help to enhance digital literacy and employability levels among visually impaired students. The academic performance, independence, and self-reliance of learners are greatly influenced by such training programs, indicating that the use of assistive technologies is most successful when integrated into the system of the programmed support (Elshemy et al., 2025; Talafha & Bataineh, 2025).

The transformational nature of assistive technologies in higher education is also highlighted by the overall importance of systematic literature reviews, especially when discussing the issues of inclusivity and accessibility hurdles (Putri et al., 2025; Prabhu & Jeyaprathaban, 2023). Nevertheless, the overall practice is still episodic because of the differences in institutional capacity, financial resources, and absence of holistic policies and strategies taking into account the specifics of the visually impaired students (Putri et al., 2025; Talafha & Bataineh, 2025).

Moreover, sustainability in the implementation of the assistive technology is essential to the long-term academic performance and fairness. Specifically designed Sustainable Artificial Intelligence (AI) solutions to the needs of visually impaired students have shown great impact on the academic achievement as they helped to align performance expectancy, social influences, and behavioral intentions toward technology usage (Elshaer et al., 2025). However, there are still practical complications that are still to be addressed, including the compatibility aspect, affordability, and accessibility limitations, which is why it is important to make institutional and policy efforts (Talafha & Bataineh, 2025).

To sum up, digital assistive technologies can be a game changer in online learning and visually impaired students, but there are considerable barriers that need to be dealt with to get the best out of them. Innovation requires the joint actions of educational institutions, policymakers, technology developers, and the visually impaired community to eliminate the current barriers to open up a path toward inclusive, equitable, and quality education of all learners (Chileshe et al., 2025; Khumalo, 2025; Talafha & Bataineh, 2025).

Statement of the Problem

The rapid transition to online learning opportunities and challenges have been posed to visually impaired students. Although Digital Assistive Technologies (DATs) are meant to fill the accessibility gaps and promote independent learning, the effectiveness of these technologies in virtual learning environments has not been explored. Online-based learning in many learning institutions has not been embraced to the full extent taking into consideration the needs of visually impaired students especially considering the nature of technologies incorporated, usability, satisfaction and their actual academic implications.

As much as the use of DATs like the screen reader, braille displays, and voice recognition software increases, doubts persist on whether the aids are actually helping the students with visual impairment to meet their academic objectives in online environments. Besides, empirical evidence is minimal to capture the perceptions of these students as far as the sufficiency and effectiveness of these technologies on real-life academic situations.

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In this study, the researchers will attempt to fill this gap by looking into the kind of DATs that is being utilized, their usability and user satisfaction, and the perceived influence they have had on the academic performance of visually impaired learners in online learning programs.

Questions of the Study

1. Which kind of digital assistive technologies (DATs) are the most predominant among visual-impaired students in an online learning environment?
2. What is the level of satisfaction of students with visual impairments with digital assistive technology to conduct their online learning?
3. What is the experience of students with visual impairments with the usefulness of digital assistive technologies in online learning?
4. What is the perceived academic effect of the usage of digital assistive technologies on the visual impairment students in online courses?
5. What is the overall perception of visual impaired students towards the effectiveness of digital assistive technology in facilitating accessibility and inclusion of individuals in the online learning environment?

Objectives of the Study

The primary question of this research is to understand how and to what extent digital assistive technologies (DATs) can be used to improve online learning conditions of students with visual impairments. Particularly, the research will do the following:

1. Determine the kind of digital assistive technologies that students with visual impairments usually use in online learning situations.
2. Compare the degree of satisfaction of students with visual impairments with the DATs they employ in virtual classrooms.
3. Evaluate the usefulness of different digital assistive tools in the eyes of the visually impaired students.
4. Assess the academic effects of utilization of DATs on student's engagement, participation, and academic performance in online courses.
5. Video-conference students to examine their general perceptions of and experience with using DATs in virtual learning, as well as barriers and facilitators they are facing.

Significance of the Study

The research has great academic, pedagogical, and practical importance. To begin with, it adds to the small pool of empirical studies devoted to the application and efficiency of Digital Assistive Technologies (DATs) of students with visual impairments online. This study presents evidence-based knowledge that can be used to develop technology, instructional design, and inclusive education policies in the future with the help of real user experience. To teachers and college/university administrations, the results of this study can assist in determining which DATs are most useful to accommodate accessibility and academic achievement in online classrooms. By identifying the usability and satisfaction rates of such technologies, educators will be able to make relevant decisions concerning the incorporation of the relevant tools and the development of teaching strategies that can accommodate the needs of the visually impaired students.

To policymakers and disability support services, this research will bring to attention the existing gaps in the support structure and where improvement, funding, and training could be done. Finally, the paper will facilitate educational equality and create a more inclusive learning environment in which blind individuals may excel as learners without interference by technology.

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In addition, the outcomes can also be used as a starting point of new studies in the special education and assistive technology sphere, and it will help to further investigate how new technologies can be used to benefit students with different disabilities in online learning environments.

Literature Review

The abrupt shift of the learning process to online tools, which was largely accelerated by the COVID-19 pandemic, has brought special challenges to the students with visual impairments. Digital Assistive Technologies (DATs) have become critical to the mitigation of such challenges as they have improved accessibility and facilitated educational equity in virtual settings.

Assistive technologies are widely understood as devices, software, or equipment that help people with disabilities to do something that they may be unable to do or struggle to do without these devices, software, or equipment (Putri et al., 2025). Screen readers (e.g., JAWS and NVDA), Braille displays, text-to-speech software, magnification tools, and AI-powered wearable technologies are some of the tools that can be used by visually impaired learners (Muradyan, 2023; Elshemy et al., 2025).

AI-powered assistive technologies (AIATs) have made a breakthrough especially in accessibility, where artificial intelligence features of object recognition, scene description, natural language processing (NLP), and text-to-speech conversion are built-in. To take one example, the Seeing AI and Envision Glasses manufactured by Microsoft can help visually impaired users to have a real-time description of the environment and the identification of objects, which gives them a lot of power (Naayini et al., 2025). These technologies can help directly in independent navigation, social experiences, and learning among visually impaired students, which can make the academic performance and living condition of students much better (Elshaer, AlNajdi, & Salem, 2025).

A number of empirical studies point out the efficacy of such technologies in the realms of education. Kanchanasuttirak (2025) utilized a systematic literature review of 37 studies (20102025) to investigate the assistive technologies in English language learning to visually impaired persons. The review presented four primary types of tools, such as screen readers, Braille display, audio-based tools, and specialized mobile applications, and multimodal strategies exhibited the best outcomes. Lexical development was fostered by screen readers and vocabulary apps, whereas Braille tools and interactive grammar drills furthered syntactic development. Pronunciation and listening were facilitated with the help of AI-enhanced audio tools. The research article has pointed out the significance of teacher training, institutional support, and learner-centered design, in addition to indicating the research gaps which included inadequate longitudinal data and culturally responsive tools. The results support the transformative influence of assistive technologies in advancing equitable learning of languages among the visually impaired students.

Elshaer et al. (2025) established a positive relationship between implementation of AIAT and academic achievements among the visually impaired university students that were significant. They also used the Unified Theory of Acceptance and Use of Technology (UTAUT) model and found that performance expectancy, social influence, and behavioral intention had a significant impact in academic performance. On the other hand, effort expectancy and facilitating conditions failed to have significant direct effects but rather affected academic performance indirectly by means of behavioral intentions (Elshaer et al., 2025).

Although DATs have the potential to transform the treatment process, numerous studies highlight the existence of major obstacles to successful use. In a study by Chileshe, Annie, and Mundende (2025) on the experiences of visually impaired students in Zambia, the difficulties of these students were highlighted, such as the limited access to the ICT tools, low availability of institutional support, inadequate provision of ICT instructors with the necessary training and the financial ability of the families to afford the necessary equipment. The same problem was observed in Zimbabwe, where the lack of proper access to such assistive technologies as JAWS and NVDA software led to the inability of visually impaired students to fully participate in e-learning platforms (Khumalo, 2025).

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It has also been highlighted that complementary training programs play a crucial role in improving DATs efficacy. As Elshemy et al. (2025) emphasized, the development of digital literacy and the employability of students with visual impairments was greatly enhanced by the specialized rehabilitative training and, therefore, the effective utilization of the assistive technologies in question. In the absence of such training, the whole potential of DATs will not be revealed, as they will be of little use in real education conditions (Talafha & Bataineh, 2025).

The integration and success of DATs are influenced by institutional and systemic factors to a great extent. Putri et al. (2025) have determined that poor infrastructure, underdeveloped policies, and insufficient awareness of educators frequently were barriers to successful DAT implementation. Additionally, Talafha and Bataineh (2025) have also mentioned that the reluctance of the institution to provide the necessary assistive technologies due to the corresponding concerns with costs and logistical challenges often limits the opportunities of the visually impaired educators and learners.

Nevertheless, the success of DATs is not limited to academic performance. The technologies also enhance independence, autonomy and social inclusion of the visually impaired persons. Muradyan (2023) underlined the fact that assistive technologies can aid not only in academic activities, but also in personal relationships, career, and quality of life, as they support sensory and cognitive requirements.

The literature implies that the policymakers, educational institutions, technology-developer, and stakeholders are all needed to work together to solve any present challenges. Among the recommended approaches are the suggestions to allocate more funds to the procurement of assistive technology, the need to obligate educators to undergo special training, and policy initiatives that should be aimed at the implementation of the inclusivity technology into mainstream education (Chileshe et al., 2025; Khumalo, 2025; Putri et al., 2025).

To sum up, digital assistive technologies are a deep possibility to help visually impaired students in online learning, but substantial institutional, systemic, and socioeconomic obstacles have to be overcome to make the most of them. A detailed plan that includes specific training, policy assistance, and cooperation with stakeholders is needed to encourage equity, inclusivity, and academic achievements among visually impaired students.

Methodology

Research Design

The research followed a quantitative descriptive research design that worked on a cross-sectional survey. It was aimed to explore the nature, applicability, satisfaction, academic outcomes, and perceptions of the Digital Assistive Technologies (DATs) in online higher study environments among visually disabled learners.

Participants

The sample of the study comprised of 20 students with visual impairments enrolled in online courses at the secondary stage

The Study Tool

A questionnaire was distributed among visual impaired students to asses the types of Digital Assistive Technologies used, their satisfaction, usability, and academic impact

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Data Collection

The questionnaire was distributed in online format in accessible formats that the visually impaired students use (e.g. screen reader Google Forms). Concepts of ethics were adhered to and the informed consent of the participants was sought. The process of gathering data lasted two weeks.

Statistical Treatment

The analysis of data was done by the SPSS. Depending on the type of each research question, the following statistical techniques were used:

- The descriptions of the types of DATs used were presented in frequencies and percentages.
- The satisfaction and the level of overall perception were measured with one-sample t-tests having a neutral point 3.
- The internal consistency of each domain was computed using Cronbachs Alpha.
- The mean ranks of the academic impact items were compared with the help of Friedman Test.
- The usability was computed using descriptive statistics (means and standard deviations).

All of the tests were run at a p value of less than.05.

Findings

Results related to the first question: Which kind of digital assistive technologies (DATs) are the most predominant among visual-impaired students in an online learning environment?

Table 1. Predominant Types of Digital Assistive Technologies (DATs) Used by Visually Impaired Students in Online Learning Environments

N	Item	Mean	Std. Deviation	t-value (vs. 3)	p-value
1	I access screen readers like the JAWS or NVDA when learning online.	4.10	0.64	7.68	0.0000
2	I constantly employ magnification assistants such as ZoomText or inbuilt OS function.	3.95	0.89	4.77	0.0001
3	Braille display devices are my tools to access the course.	3.25	1.25	0.89	0.3842
4	I work with voice recognition software to do my assignments.	4.05	0.76	6.13	0.0000
5	I use special mobile applications that work with visual impairments.	4.00	0.79	5.64	0.0000

The findings of the results on how the visually impaired students use various Digital Assistive Technologies (DATs) in online learning set-ups have been captured in Table 1. The findings portray that the students are most likely to use screen readers such as JAWS or NVDA when they are undertaking online learning tasks ($M = 4.10$, $SD = 0.64$), which is far beyond the evidence of 3 in the neutral point scale ($t = 7.68$, $p < 0.001$). Furthermore, the use of tools that provide magnification (ZoomText or magnification capabilities within operating systems) was also identified as almost always used by students ($M = 3.95$, $SD = 0.89$) and significantly above the indifference mark ($t = 4.77$, $p < 0.001$).

Braille display devices, on the other hand, were used less often by the students ($M = 3.25$, $SD = 1.25$), though this finding did not show a significant difference when compared to neutral ($t = 0.89$, $p = 0.3842$), indicating that there is no particular preference to their use or not. Conversely, students noted that they strongly depended on voice recognition software to accomplish assignments ($M = 4.05$, $SD = 0.76$; $t =$

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6.13, $p < 0.001$) and, likewise, they used specialized mobile applications targeted at the needs of visually impaired users quite often ($M = 4.00$, $SD = 0.79$; $t = 5.64$, $p < 0.001$).

All in all, these results show that the visually impaired students put a huge emphasis on screen readers, magnification assistants, voice recognition software, and mobile apps, which proves their importance as the key tools to facilitate their involvement in online education and academic achievements.

Results related to the second question: What is the level of satisfaction of students with visual impairments with digital assistive technology to conduct their online learning?

Table 2: Level of Satisfaction Among Visually Impaired Students with Digital Assistive Technologies (DATs) in Online Learning Environments

N	Item	Mean	Std. Deviation	t-value	p-value
6	I am content with the variety of assistive technologies that I have.	3.81	0.34	10.84	0
7	In most online classes, DATs satisfy my learning needs.	3.89	0.43	9.23	0
8	In online learning, I am comfortable using DATs.	3.64	0.42	6.84	0
9	I have a positive attitude towards DATs in general.	3.85	0.39	9.73	0
10	I would suggest such technologies to other students who have the same needs.	3.6	0.45	5.89	0

The following table 2 shows the extent to which visually impaired students were satisfied with their experience with Digital Assistive Technologies (DATs) in online learning environment. On the whole, the students were significantly above the neutral midpoint of 3 ($t = 10.84$, $p < .001$) with the overall mean of 3.81 ($SD = 0.34$) in terms of their satisfaction with the range of assistive technologies at their disposal. They also stated that DATs met their learning requirements well in the majority of online courses ($M = 3.89$, $SD = 0.43$) which once more was significantly higher than the midpoint ($t = 9.23$, $p < .001$).

In addition to that, students also felt comfortable using DATs in online learning ($M = 3.64$, $SD = 0.42$) and this was significantly higher than neutrality ($t = 6.84$, $p < .001$). The students also exhibited a high level of positive attitude towards DATs in general ($M = 3.85$, $SD = 0.39$; $t = 9.73$, $p < .001$). In addition, the students reported that they were ready to refer such technologies to other visually impaired peers who could also use such assistance ($M = 3.60$, $SD = 0.45$), which is significant as well ($t = 5.89$, $p < .001$).

All these findings prove that the level of satisfaction is positive among visually impaired students when it comes to the possibility of using DATs, its comfort, and usefulness overall in enabling their interaction and academic achievements in the online educational setting.

Results related to the third question: What is the experience of students with visual impairments with the usefulness of digital assistive technologies in online learning?

Table 3. Table 3: Experiences of Visually Impaired Students Regarding the Usability of Digital Assistive Technologies (DATs) in Online Learning Environments

N	Item	Mean	Std. Deviation	t-value	p-value
11	The assistive technologies have an easy learning and operation design.	3.84	0.55	6.86	0
12	When using DATs the number of technical problems that I have is minimal.	3.66	0.51	5.76	0
13	The DATs fit into the online learning portal in my university.	3.4	0.33	5.46	0
14	NAV/User interface of DATs is easy to use.	3.77	0.73	4.7	0

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15	It has updates and technical support as and when required.	3.65	0.55	5.32	0

Table 3 presents visually impaired students' narratives pertaining to their experiences with the usability components of Digital Assistive Technologies (DATs) in online learning environments. Students found the technologies easy to learn and operate, rating this aspect very positively, significantly above the neutral midpoint of 3 ($M = 3.84$, $SD = 0.55$; $t = 6.86$, $p < .001$). Meanwhile, students experienced a small amount of technical difficulties when using DATs ($M = 3.66$, $SD = 0.51$) and that is a significantly higher rating than the neutral reference point ($t = 5.76$, $p < .001$).

Moreover, students averagely agreed that DATs were well integrated into online learning portals of their university ($M = 3.40$, $SD = 0.33$) which was significantly higher than neutrality ($t = 5.46$, $p < .001$). DATs user interface and navigation (NAV/UI) was also user friendly once again at a level well above neutral ($M = 3.77$, $SD = 0.73$; $t = 4.70$, $p < .001$). Finally, the students were satisfied with the presence of timely update information and technical support when necessary ($M = 3.65$, $SD = 0.55$), which is significantly more than the neutral midpoint ($t = 5.32$, $p < .001$).

On the whole, this evidence indicates that visually impaired learners find DATs to be easy to use, convenient, and supported tools, and that is why they can use and apply them in online learning environments effectively and efficiently.

Results related to the fourth question: What is the perceived academic effect of the usage of digital assistive technologies on the visual impairment students in online courses?

N	Item	Mean	Std. Deviation	t-value	p-value
16	The DATs assist me in execution of academic assignments faster.	3.9	0.27	14.9	0
17	There has been an improvement in my grades because of the DATs.	3.96	0.34	12.52	0
18	DATs help me be a full member of the virtual conversations.	3.99	0.31	14.51	0
19	With DATs I am able to deliver assignments on time easily.	3.93	0.26	15.88	0
20	There are some positive influences DATs have had on my academic performance.	3.93	0.28	14.68	0

The interviewees of Table 4 are students with visual impairments, and their visual perceptions on the academic consequences of using Digital Assistive Technologies (DATs) in their online coursework are summarized. Students also strongly agreed that DATs helped them to complete academic tasks in a shorter duration ($M = 3.90$, $SD = 0.27$) way beyond the neutral midpoint of 3 ($t = 14.90$, $p < .001$). In addition, students also found significant increase in their academic grades due to DATs usage ($M = 3.96$, $SD = 0.34$), which also significantly exceeded the neutrality ($t = 12.52$, $p < .001$).

Still, participants confirmed that DATs supported the active and full engagement in virtual discussions ($M = 3.99$, $SD = 0.31$), and it is a significant agreement level higher than the neutral point ($t = 14.51$, $p < .001$). They also concurred that DATs enhanced their capacity to hand in their assignments on time greatly ($M = 3.93$, $SD = 0.26$; $t = 15.88$, $p < .001$). Lastly, the students also acknowledged that DATs affected their studies in a generally positive way ($M = 3.93$, $SD = 0.28$), once again much higher than the center point of neutrality ($t = 14.68$, $p < .001$).

All these findings strongly point out that visually impaired students recognize DATs as a major improvement of their academic efficiency, promptness, submission of assignments and overall academic performance in online learning platforms.

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Results related to the fifth question: What is the overall perception of visual impaired students towards the effectiveness of digital assistive technology in facilitating accessibility and inclusion of individuals in the online learning environment?

N	Item	Mean	Std. Deviation	t-value	p-value
21	In my opinion, inclusive education cannot exist without DATs.	4	0.3	15.04	0
22	Without DATs it would be hard to incorporate online learning.	3.95	0.48	8.81	0
23	In the digital classrooms, DATs lessen the learning boundaries.	4.03	0.37	12.56	0
24	These technologies have made me a self-sufficient learner.	3.88	0.36	10.89	0
25	My right to equal right of access to education is strengthened with the help of DATs.	4.12	0.48	10.51	0

Table 5 shows a visual representation of the overall perception of visually impaired students on how effective Digital Assistive Technologies (DATs) are in creating accessible and inclusive education in online learning settings. Students confirmed powerfully that inclusive education is impossible without DATs ($M = 4.00$, $SD = 0.30$), which was highly significantly above the neutral midpoint of 3 ($t = 15.04$, $p < .001$). Also, students reported that it would be quite challenging to use online learning without DATs ($M = 3.95$, $SD = 0.48$), which was also significantly greater than neutral ($t = 8.81$, $p < .001$).

Students were convinced that DATs help to overcome learning barriers in digital classrooms successfully ($M = 4.03$, $SD = 0.37$) and were sufficiently higher than the neutral level ($t = 12.56$, $p < .001$). In addition, students indicated that the technologies had played a significant role in making them self-sufficient learners ($M = 3.88$, $SD = 0.36$), which was significantly higher than the midpoint ($t = 10.89$, $p < .001$). Lastly, subjects felt very strongly that their right to equal access to education had been enhanced by the usage of DATs ($M = 4.12$, $SD = 0.48$) which is much higher than a neutral point ($t = 10.51$, $p < .001$).

Discussion of the Results

Students believed that they can successfully break down learning barriers in digital classrooms with the assistance of DATs ($M = 4.03$, $SD = 0.37$) and were significantly higher than the neutral level ($t = 12.56$, $p < .001$). Also, the students stated that the technologies had contributed greatly to their independence as learners ($M = 3.88$, $SD = 0.36$) and that the value was greater than the midpoint ($t = 10.89$, $p < .001$). Finally, the subjects were strongly inclined to believe that their right to equal access to education had been amplified by the use of DATs ($M = 4.12$, $SD = 0.48$) which is significantly greater than a neutral point ($t = 10.51$, $p < .001$).

Out of the results provided in Table 1, it can be established that screen readers, magnifiers, and voice recognition software are the most commonly used DATs among the visually impaired students. This observation corresponds to that of Muradyan (2023) who stressed that screen readers like JAWS and NVDA are vital in the conversion of digital text to speech, which enables students to consume course materials. In the same way, the common use of magnification tools substantiates the findings of Putri et al. (2025) who categorized those technologies as indispensable to moderate visual impairments. This type of low utilization of Braille displays, however, can be related to Khumalo (2025), who has stated that because of the high costs and scarcity of Braille-based tools in institutions, they are less prevalent in the developing world.

Table 2 shows that there is a great degree of satisfaction among the students with regard to the DATs they use. This is the same as what Elshaer et al. (2025) found out, that DATs have a positive effect on behavioral intention and performance expectancy, which enhance satisfaction and academic performance. Similarly,

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Elshemy et al. (2025) found that, among students who have undergone training in assistive technology, satisfaction and readiness to use the tool further were found more commonly.

Students did not find anything negative in the usability of DATs, and most of them rated easiness of usage, technical problems, and interface friendliness very high in Table 3. These conclusions are in line with the research conducted by Naayini et al. (2025), who demonstrated the way in which user-friendly tools such as Seeing AI and Envision Glasses facilitate navigation and communication. In the same line, Talafha and Bataineh (2025) established that in case of intuitive and well-supported DATs, the teaching and learning experiences of students and teachers with visual impairments are enhanced greatly.

Academic (see Table 4) effects of DATs were positive and significant, as indicated by students, who described gaining more knowledge in completing assignments, obtaining higher grades, and discussing in virtual surroundings. This agrees with the study results of Elshaer et al. (2025), who concluded that there is a direct correlation between the use of DAT and academic performance. Elshemy et al. (2025) also stressed that, assistive technology training has a direct correlation with student achievement, which is one of the reasons why DATs, when properly enabled, can be not only access tools, but also academic growth accelerators.

Table 5 highlights the perception that students have that inclusive education is not possible without DATs. This is consistent with what Khumalo (2025) claimed in the area of e-learning platforms, and that is that having no accessibility features systematically shuts out visually impaired learners. In addition, the perceptions of the students that DATs empower their right to equal education support the findings of Chileshe et al. (2025) who proposed that more institutional support to the use of assistive technologies is needed to address digital disparities. The ideology that DATs help to establish the principles of learner autonomy and diminish educational barriers can also be identified with Muradyan (2023) who identified that DATs can enhance the quality of life by promoting autonomy in both educational and daily contexts.

This research is however a little different to some conclusions made by Talafha and Bataineh (2025) who mention that there still exists an institutional hesitation to the integration of DATs because of cost, logistics impediments. The students in this study did not report the same degree of challenges as observed by the students in the previous studies, although their responses were also more positive in general, which could be attributed to some improvements in infrastructure or support services at a local level.

Overall, the findings of the present study support a large amount of current literature that establishes the usefulness of Digital Assistive Technologies among visually impaired students. The uniformity of variables, such as satisfaction, usability, academic enhancement, and perceived inclusivity, outlines the transformative potential of DATs in case of their successful implementation. However, both the literature and the present research results suggest the need to advocate further, intervene on policy, and allocate more resources so that these technologies can be made universal and sustainable in terms of their integration into the online education system.

References

Chileshe, E., Annie, P., & Mundende, K. (2025). Experiences of learners with visual impairment in the use of information communication technology in two selected schools in Kabwe district. International Journal of Research and Innovation in Social Science, 9(IIIS), 2898-2907. https://dx.doi.org/10.47772/IJRISS.2025.903SEDU0219

Elshaer, I. A., AlNajdi, S. M., & Salem, M. A. (2025). Sustainable AI solutions for empowering visually impaired students: The role of assistive technologies in academic success. Sustainability, 17(12), 5609. https://doi.org/10.3390/su17125609

Elshemy, R., Alzahrani, F., Fawzy, S., Almasoudi, F., Moussa, Y., & Elsayed, M. (2025). Bridging to possible: Empowering visually impaired students through assistive technology rehabilitative training. Edelweiss Applied Science and Technology, 9(4), 1160-1175. (https://doi.org/10.55214/25768484.v9i4.6190)

Kanchanasuttirak, P. (2025). Assistive technologies for English language learning in visually impaired individuals. World Journal of Advanced Research and Reviews, 25(3), 2204–2211. https://doi.org/10.30574/wjarr.2025.25.3.0841

Khumalo, C. (2025). The inclusion of students with visual impairment on e-learning platforms post-COVID-19 in Zimbabwe. International Journal of Education and Development using Information and Communication Technology, 21(1), 141-156.

Journal of Ecohumanism
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Muradyan, S. (2023). Assistive technology for students with visual impairments. Special Education Journal, 6(1), 77-79. https://doi.org/10.24234/se.v6i1.309

Naayini, P., Myakala, P. K., & Bura, C. (2025). AI-powered assistive technologies for visual impairment. Retrieved from http://arxiv.org/abs/2503.15494v1

Prabhu, P., & Jeyaprathaban, S. (2023). Assistive and digital technology for the education of students with visual disabilities. International Journal of Research and Review. https://doi.org/10.52403/ijrr.20230287

Putri, N. K. S., Yuhana, U. L., Siahaan, D. O., Rahayu, W., & Pardede, E. (2025). Assistive technology classification for students with disabilities in higher education. IEEE Access, 13. https://doi.org/10.1109/ACCESS.2025.3538322

Talafha, W. F., & Bataineh, R. F. (2025). Breaking barriers: Assistive technology for visually impaired EFL educators. International Journal of Learning, Teaching and Educational Research, 24(4), 813-829. (https://doi.org/10.26803/ijlter.24.4.38)

World Health Organization. (2022). Visual impairment and blindness. Retrieved from https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

Zenda, T., Muriza, C., & Mujuru, S. (2024). Digital inclusion for students with disabilities during COVID-19. Educational Journal of Zimbabwe, 15(2), 75-88.

The Study Tool

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N	**Item**	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	Types of Digital Assistive Technologies (DATs) Used					
1	I access screen readers like the JAWS or NVDA when learning online.					
2	I constantly employ magnification assistants such as ZoomText or inbuilt OS function.					
3	Braille display devices are my tools to access the course.					
4	I work with voice recognition software to do my assignments.					
5	I use special mobile applications that work with visual impairments.					
	Satisfaction with DATs					
6	I am content with the variety of assistive technologies that I have.					
7	In most online classes, DATs satisfy my learning needs.					
8	In online learning, I am comfortable using DATs.					
9	I have a positive attitude towards DATs in general.					
10	I would suggest such technologies to other students who have the same needs.					
	Usability of DATs					
11	The assistive technologies have an easy learning and operation design.					
12	When using DATs the number of technical problems that I have is minimal.					
13	The DATs fit into the online learning portal in my university.					
14	NAV/User interface of DATs is easy to use.					
15	It has updates and technical support as and when required.					
	Academic Impact of DATs					
16	The DATs assist me in execution of academic assignments faster.					
17	There has been an improvement in my grades because of the DATs.					
18	DATs help me be a full member of the virtual conversations.					
19	With DATs I am able to deliver assignments on time easily.					
20	There are some positive influences DATs have had on my academic performance.					
	Perception of Effectiveness					
21	In my opinion, inclusive education cannot exist without DATs.					
22	Without DATs it would be hard to incorporate online learning.					
23	In the digital classrooms, DATs lessen the learning boundaries.					

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24	These technologies have made me a self-sufficient learner.					
25	My right to equal right of access to education is strengthened with the help of DATs.					