2021

The role of Assistive Technology (AT) in Enhancing the Educational Experience of Students with Special Needs in Higher Education: A Case of University of Zimbabwe Library

Agnes C. Chikonzo
University of Zimbabwe Library, achikonzo@uzlib.uz.ac.zw

Masimba Muziringa
University of Zimbabwe Library, mmuziringa@uzlib.uz.ac.zw

Jonathan Munyoro
University of Zimbabwe Library, jmunyoro@uzlib.uz.ac.zw

The role of Assistive Technology (AT) in Enhancing the Educational Experience of Students with Special Needs in Higher Education: A Case of University of Zimbabwe Library

Authors:

1. Dr. Agnes C Chikonzo
   University Librarian
   University of Zimbabwe Library
   P. Bag MP45 Mt, Pleasant
   Harare, Zimbabwe
   0242 303211
   achikonzo@uzlib.uz.ac.zw

2. Mr. Masimba Muziringa
   Deputy Librarian, Research and Learning
   University of Zimbabwe Library
   P. Bag MP45 Mt Pleasant
   Harare, Zimbabwe
   0242 303211
   mmuziringa@uzlib.uz.ac.zw

3. Mr. Jonathan Munyoro
   Information and Knowledge Management Specialist
   University of Zimbabwe Library
   P Bag MP45 Mt Pleasant
   Harare, Zimbabwe
   +263 0242 303211/ +263 773 181 980
   jmunyoro@uzlib.uz.ac.zw

Abstract

The study examined how assistive technology (AT) is being used to enhance the educational experience of learners with special needs at the University of Zimbabwe. Using a case study design, primary data were collected mainly through questionnaires from a sample of 82 respondents comprising students with visual impairment and albinism registered with the University of Zimbabwe Disability Support Services Library, a branch of University of Zimbabwe Library. The study results demonstrated that AT provides freedom by enabling respondents to complete academic activities that they were previously unable to do, such as studying, reading, writing, researching, web browsing, emailing, communicating with lecturers, taking notes, communicating with peers about academic work, and preparing for exams. The study showed that AT enables students with special needs to do academic tasks more effectively and obtain academic material relevant to their studies, as well as improve social interactions, self-confidence, and peer-to-peer engagement. Overall, the study supports the notion that using AT can improve academic engagement and social interaction. Key recommendations for optimising AT usage by students with special needs at the University of Zimbabwe include partnering with organisations and experts in the AT sector to provide more robust training in digital accessibility concepts for personnel, negotiating with the parent ministry to make AT more affordable in higher education, promoting the manufacturing of appropriate AT devices at the University of Zimbabwe through a new faculty, producing experts in the teaching of students with special needs, as well as adopting low-cost AT products.

Introduction

About 15% of the world's population has some form of disability (World Health Organisation, 2011). As the number of students with special needs in higher education is increasing (Kendall, 2016, p. 1; Majoko, 2019, p. 1; Moriña, 2017, p. 4) inclusive education has been extensively accepted in many countries (Sibanda, 2018). Sibanda (2018, p. 809), assert that inclusive education is "the only realistic means of achieving education for all". Inclusive education has brought with it a much-needed share of equity in approach to the education of the students with special needs by providing them with a level field to appropriately showcase their diverse talents, demonstrating themselves capable enough to study and perform together, on par with their non-disabled classmates (Ahmad, 2015, p. 62). In terms of educational provisions, inclusive education is ideally concerned with presence, equity, fairness, participation, diversity, and access (Sibanda, 2018, p. 809). Since the adoption of the United Nations "Convention on the Rights of Persons with Disabilities" (CRPD) in 2006, assistive technology (AT) has been promoted as a means to promote personal independence (Maor et al., 2011), increase access to information (Pomputius, 2020), assist students in achieving positive educational outcomes (Ahmad, 2015; Gronlund et al., 2010), and as a tool for translating the sustainable development goals (SDGs) into practical results (Tebbutt et al., 2016). Despite the advancement of AT over the years, published research in this area remains very low in developing countries (Harniss et al., 2016, p. 267; R. Matter et al., 2016, p. 1). Research on inclusive education has been concentrated on the successes in developed nations (Ahmad, 2015, p. 62), and a limited amount of research has been published to describe how AT is used in higher education settings (Malcolm & Roll, 2017, p. 91). Given the growing number of students with special needs enrolled in Zimbabwe's higher education (Majoko, 2018), expanded evidence is needed to increase understanding of the role of AT in enriching the educational

experience of learners with special needs. It is in this light that this study seeks to examine how AT is being used to enhance the educational experience of students with vision impairment and albinism at the University of Zimbabwe (UZ).

Use of AT in inclusive education

The term assistive technology has been defined as any "item, piece of equipment, or product system, whether acquired commercially, modified, or customised, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (World Health Organisation, 2011, p. 101). In Zimbabwe, the term AT is used to refer to "appropriate aids, appliances, technologies and other support systems that facilitate optimum functioning and participation of persons with disabilities" (*National Disability Policy [Zimbabwe*], 2021, p. 15). Braille embossers, screen magnifiers, screen readers, voice recognition applications, text-to-speech synthesizers, talking books, and large print processors are examples of AT for visually impaired persons (Tripathi & Shukla, 2014, p. 105).

Previous scholars have provided evidence on some of the benefits of utilising AT, but many of these studies are from outside Zimbabwe. For example, Borg et al. (2012) found that the use of AT improves the chances of enjoyment of human rights. Alnahdi (2014) demonstrates that students with special needs can benefit from using AT to increase and improve their independence in academic activities, and the completion of some challenging educational tasks. A study by Clouder et al. (2019) in North African countries found that AT encouraged increased independence by allowing students to execute activities that they were previously unable to. In McNicholl et al. (2021), AT usage was found to improve academic performance, promote learning and engagement with educational materials, and enhance the academic success of students.

University of Zimbabwe Library AT services

Efforts to improve access of AT to the UZ community dates back to 2011 when the UZ Library successfully implemented the Electronic Information for Libraries - Free and Open Source Software (EIFL-FOSS) Pilot Project, which paved the way for the provision of AT for students with special needs (Lack et al., 2013). Through collaboration with internal departments and the corporate world (Kusekwa et al., 2016), successive efforts were made to scale up AT implementation by the Library and this culminated in the adoption of various technologies that address different functional areas. Table 1 provides a profile of AT devices and services provided through the UZ Main Library and Disability Support Services (DSS) Library.

Table 1: Profile of UZ Library AT Services

Category/Function	Relevance of devices	Devices/Services Available
Screen Reading Software	Screen reading software reads the text on the computer screen using a speech synthesiser or a braille display. Designed for students with visual impairments who can't view screen information or navigate with a mouse because of their condition. The software allows students to browse the Internet and access documents in electronic formats.	• Computers and Laptops installed with screen readers • JAWS (Job Access With Speech) and NVDA (NonVisual Desktop Access)
OCR Scan and Read	OCR (Optical Character Recognition) allows users to transform printed papers into editable forms that may	Open Book and Pearl Reading Camera

	subsequently be read aloud in voice by persons who are blind or with low vision.	
Book Readers/Voice Recorders	Hardware devices are used by students with visual impairment to record lectures and meetings, as well as playback audiobooks, music, voice recordings, and text files.	• ET Blaze • Sensory PBRW • Book Sense
Braille Printers/Embossers	Braille embossers use braille translation software to convert texts into braille, which is subsequently printed on braille paper. Used for the production of documentation or conversion of study material into Braille.	Heavy Duty Braille Embosser
Electronic Magnifiers	Technology that uses a camera to project a magnified text image on a built-in monitor or a computer monitor	• Merlin Desktop Magnifier • Ruby Handheld Magnifier
Screen Magnification	Learners may increase text and pictures on a computer screen utilising a variety of characteristics such as colour, font size, and pointers with screen magnification software.	Magic Screen Magnification
Calculator	For use by those with visual impairments in statistics and other math courses.	Talking Scientific Calculator

Source: University of Zimbabwe Library (2021)

To provide evidence on how these devices are being used by students with special needs at the University of Zimbabwe, three broad research questions guided this study:

1. How is AT being used by students with visual impairments and albinism at the University of Zimbabwe?
2. What benefits are derived from the use of assistive devices by the students?
3. What strategies are required to improve the use of AT by the students at the University of Zimbabwe?

Methodology

This study employed a case study design which is described by Yin (2018) as a type of empirical research that investigates a complex phenomenon in their settings. The motivation to use a case study emanated from the fact it would enable researchers to investigate the phenomenon in the context of a study site providing education to students with special needs. The University of Zimbabwe was identified because of its experience in offering education to learners with disabilities (Dziva et al., 2018, p. 6). Data was collected from students with special needs who are registered with DSS which is a department of the University of Zimbabwe. A total of 195 students with disabilities are registered with DSS, 74 being visually impaired, 77 being physically challenged, 29 having albinism, 13 being hearing impaired, and two being epileptic. This study focused on students with visual impairments and albinism who are the primary users of AT devices available in the UZ Main Library and DSS Library. Therefore, the target population for this study was 103 students comprising students with visual impairments and albinism.

A sample size of 82 respondents was determined from a population of 103 students, with an error margin of 5% and a confidence level of 95%. Sample size calculation was determined based on the following formula (Gill et al., 2010):

n= p (100-p)z2/E2, where

n is the required sample size;

P is the percentage occurrence of a state or condition;

E is the margin of error(the level of precision); and

Z is the value corresponding to the level of confidence required.

Simple random sampling was used to identify participants because it provides each respondent with an equal chance to be selected and eliminate researcher bias (Taherdoost, 2016).

Quantitative methods were employed to collect and analyse data because they make it possible to gather a large collection of findings and present them clearly in numerical or statistical form (Yilmaz, 2013). Questionnaires were used as the major data collection method for this research. Self-completed questionnaires were converted and distributed in braille format, as well as through Google Forms to reach respondents who were not physically on campus. The electronic questionnaire version was distributed via mobile applications. A pilot testing of the research instrument was conducted with six academics before implementing it and results were utilised to eliminate misleading questions. Ethical considerations were observed in this study. At the commencement of data collection, the study's purpose was clearly stated to the respondents, and informed permission was gained without coercion. Individuals' involvement was purely voluntary, and participants could opt-out at any time. Respondents' identities were withheld to ensure

anonymity. Google Forms and the Statistical Package for Social Sciences (SPSS) were used in the study to process and analyse the data.

Results

The study findings are organised into sub-headings based on the themes that emanated from the questionnaire.

Response rate

Questionnaires were distributed to a sample population of 82 respondents and 46 valid responses were obtained giving a response rate of 56%. The demographic profiles of respondents are summarised in Table 2. Respondents comprised 34 (73.9%) students with visual impairments and 12 (26.1%) students with albinism. The data show that 25 (54.3%) respondents were males and 21 (45.7%) were females. The data, therefore, indicate that majority of respondents came from male students. In terms of age group, 38 (82.6%), were in the age group 20-29 years recording, while only eight (17.4%) were in the age group 30-39 years. This could be explained by the fact that the majority of students in tertiary institutions are young adults. The data also show that 31 (67.4%) of the respondents were undergraduate students, whereas 15 (32.6%) were postgraduate students. This may imply that students with special needs may be facing additional challenges that hinder them from progressing to postgraduate programmes.

Table 2: Profile of Respondents (N=46)

Variable	**Count**	**Percentage**
Type of disability		
Visual impairment	34	73.9%
Albinism	12	26.1%
Gender		
Female	21	45.7%
Male	25	54.3%
Age		
20-29 years	38	82.6%
30– 39 years	8	17.4%
Student Category		
Undergraduate	31	67.4%
Postgraduate	15	32.6%
Level		
1st year	9	19.6%
2nd year	18	39.1%
3rd year	8	17.4%
4th year	6	13%
5th year	5	10.9%

Figure 1 shows the distribution of respondents by Faculty. The data indicate that eight (17.4%) were from Arts and Humanities, three were from Business and Management Sciences and Economics, one (2.2%) from Computer Engineering, Informatics and Communications, nine (19.6%) from Education, six (13%) from Law, two (4.3%) from Medicine and Health Sciences, and 17 (37%) from Social and Behavioural Sciences. This implies that the enrolment of students with special needs at the University of Zimbabwe is more inclined towards social and behavioural science-related programmes.

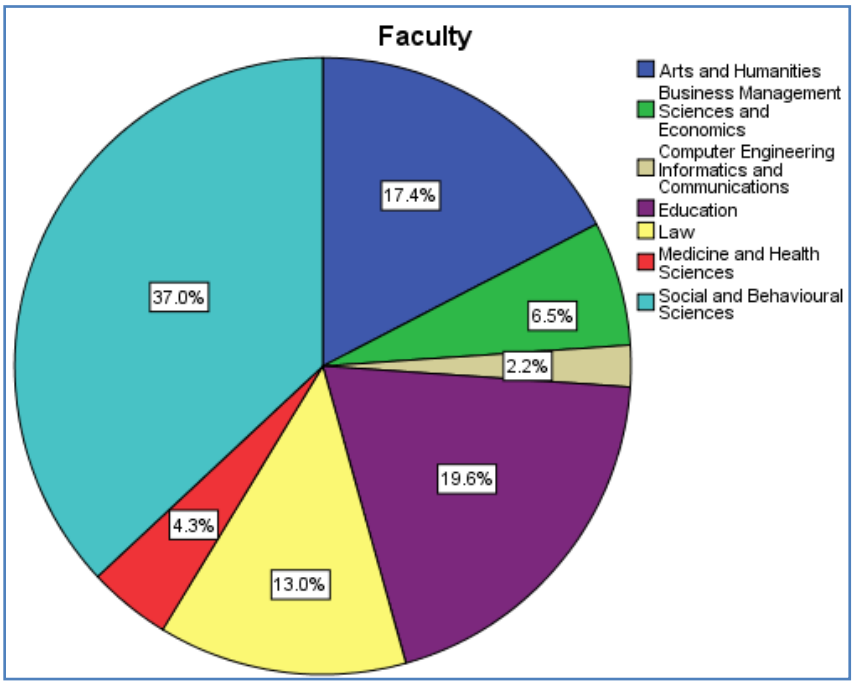

Figure 1: Distribution of Respondents by Faculty

Access to AT devices

Respondents were asked to indicate from where they accessed assistive devices to use for their academic activities and the results are displayed in Figure 2.

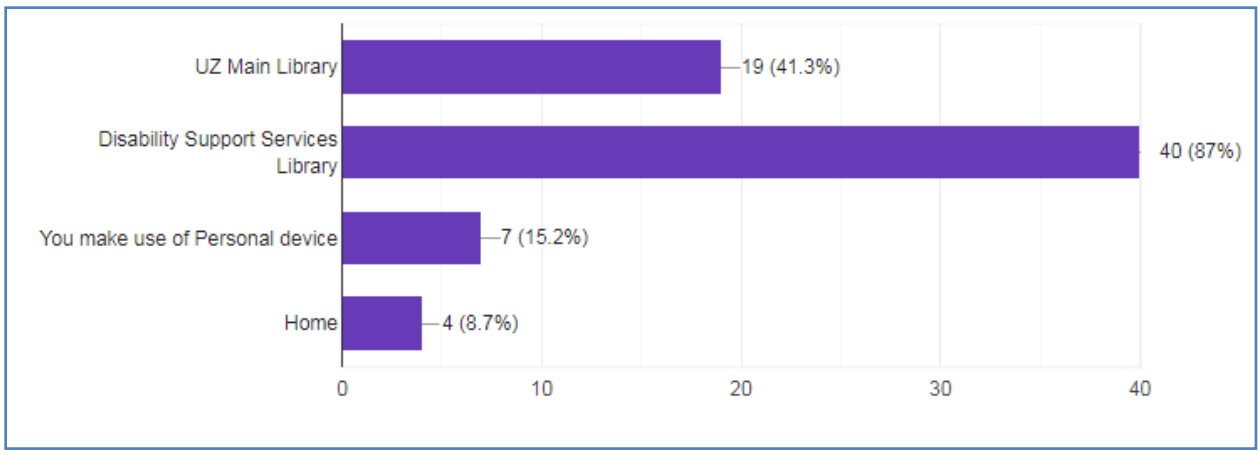

Figure 2: Access Locations for AT devices

The data shows that 40 (87%) relied on the DSS Library, 19 (41.3%) cited UZ Main Library, 7 (15.2%) used personal devices, whereas 4 (8.7%) accessed AT devices from home. The study shows that the majority of respondents rely on Library facilities for accessing AT services. This is less surprising given that very few individuals can finance their AT needs on their own since assistive devices are most expensive. Also, the government is not yet able to meet the assistive needs of all persons with special needs in the country (Dziva et al., 2018). The results are in agreement with Malcolm & Roll (2017) who found that most tertiary students access AT devices through university library facilities.

Types of devices used

The study requested respondents to indicate what type of devices they used for academic purposes and the results are illustrated in Figure 3. From a total of 46 responses, 30 (65.2%) indicated they used computers installed with JAWS, 18 (39.1%) used computers with NVDA, 24 (52.2%) used OpenBook and Pearl Reading Camera, 18 (39.1%) utilised the Braille Embosser/Printer, 20 (43.5%) used electronic magnifiers, while 24 (52.2%) used book readers/voice recorders. Again,

18 (39.1%) showed that they used the Talking Scientific Calculator, whereas about 30 (65.2%) used the Talkback Application available on smartphones.

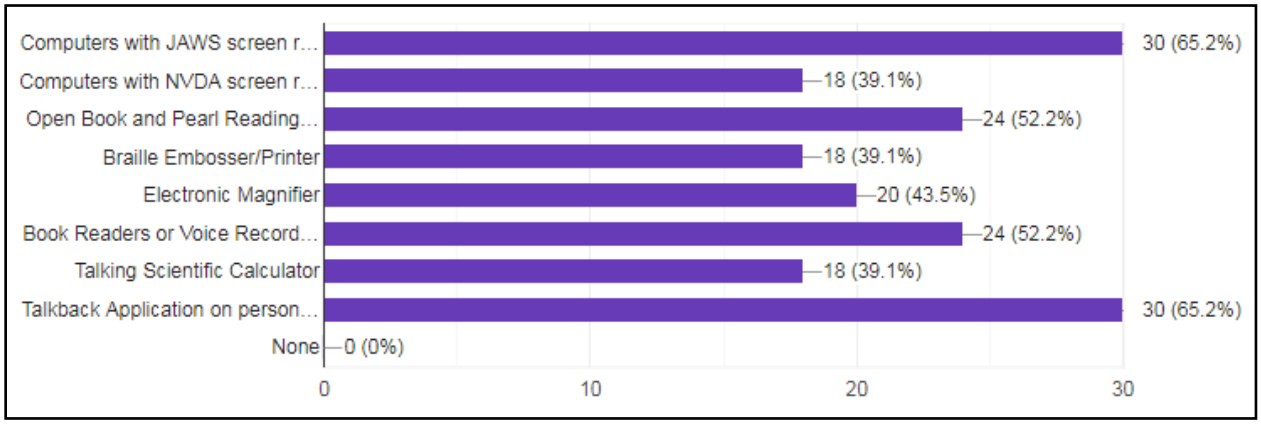

Figure 3: Types of devices used

The results show that respondents are familiar with different AT devices that can be used in education (Ahmad, 2015; Green, 2018), and this can be attributed to the regular AT training that is offered by the Library to all students with special needs. A significant level of user awareness of the AT devices available essentially contributes to the high usage of the devices (Marasinghe et al., 2015). Access to AT tools such as screen reading tools that can properly engage with digital materials is becoming increasingly common as course content is being delivered through electronic methods.

Academic Tasks accomplished

Respondents stated that they used AT for a variety of different academic tasks summarised in Figure 4. The academic tasks for which students relied on AT the most were studying (95.7%), reading (95.7%), writing (89.1%) and research (87%). Other academic tasks that were cited by respondents include examination preparation (84.8%), note-taking (76.1%), web browsing

(78.3%), communicating with lecturers (78.3%), emailing (78.3%), and communication with peers on academic work (71.7%).

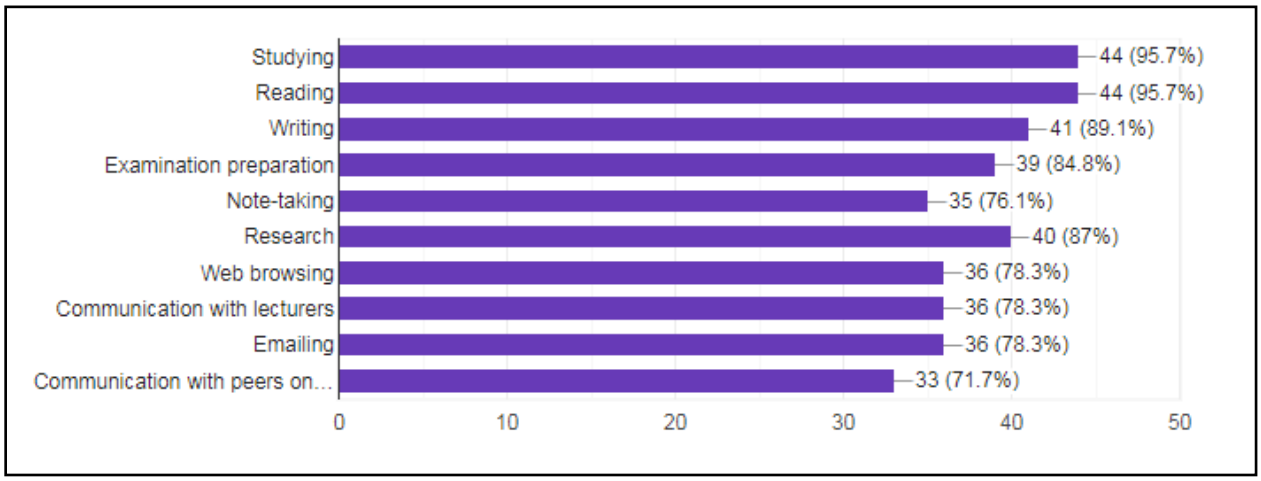

Figure 4: Academic Tasks

The results indicate that AT enables students to perform academic tasks in a variety of settings, both in the classroom and outside the classroom. This implies that students need to have AT solutions where they need them, to allow them to use them wherever and whenever it is necessary. Loaning out AT equipment and setting up multi-location access points for AT software and hardware is therefore critical to support AT use in a variety of settings (Malcolm & Roll, 2017).

Benefits of AT use by students

Respondents were asked to rate their degree of agreement with the benefits of utilising AT on a five-point Likert scale, with Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). The statistical analysis results based on mean scores are shown in Table 3. The results in Table 3 show that all of the statements were ranked as very important benefits derived from using AT, with mean values of over 4.5. The data show that benefits that are ranked as important by respondents include enabling students to complete academic tasks more easily and efficiently,

enabling students to access academic material more conveniently, allowing students to access academic information related to one's courses, as well as helping to improve learning and academic performance. The other important benefits rated high by respondents include increasing independent living, increasing motivation and self-confidence and improving student's engagement and collaboration.

Table 3: Item Analysis

	N	Min	Max	Mean	Std. Deviation
AT enable me to complete academic tasks more easily and efficiently	46	3	5	4.72	.502
I can access academic materials more conveniently using AT	46	3	5	4.65	.566
AT allows me to access academic information related to my courses	46	3	5	4.65	.526
Using AT help to improve my learning and academic performance	46	3	5	4.63	.532
Using AT boost my independence	46	3	5	4.59	.541
Using AT increases my social interactions	46	3	5	4.57	.583
Using AT increases my motivation and self-confidence	46	3	5	4.54	.585
Using AT increases my engagement and collaboration with peers	46	3	5	4.54	.585
Valid N (listwise)	46				

The results show that using AT has several major advantages as suggested in prior studies (Burgstahler, 2003; Clouder et al., 2019), including making it easier for students with special needs to execute academic activities and connect with and access academic material linked to their

courses. Increased social contact, self-confidence, and peer participation are all benefits of using AT. The findings support the notion that AT facilitates students' academic engagement and social participation (McNicholl et al., 2021).

Training and Strategies to Optimise AT Usage

It's crucial to assess the extent to which respondents can use AT independently and think about which training approaches will provide respondents with the best chance of learning to utilise AT effectively. As illustrated in Figure 5, a majority of respondents strongly agreed (43.5%) and agreed (37%) that they were able to use AT independently, while 19.6% of respondents were neutral and require additional training. Figure 6 show that respondents prefer to learn AT through guided practice (58.7%) and independent practice (52.2%), as well as through demonstration (45.7 %). In contrast, just 26.1% of the respondents said that reading a manual was a helpful approach to learn how to use an AT. The study point to the need to use a variety of training methods to accommodate the needs of various students (Green & Blair, 2011).

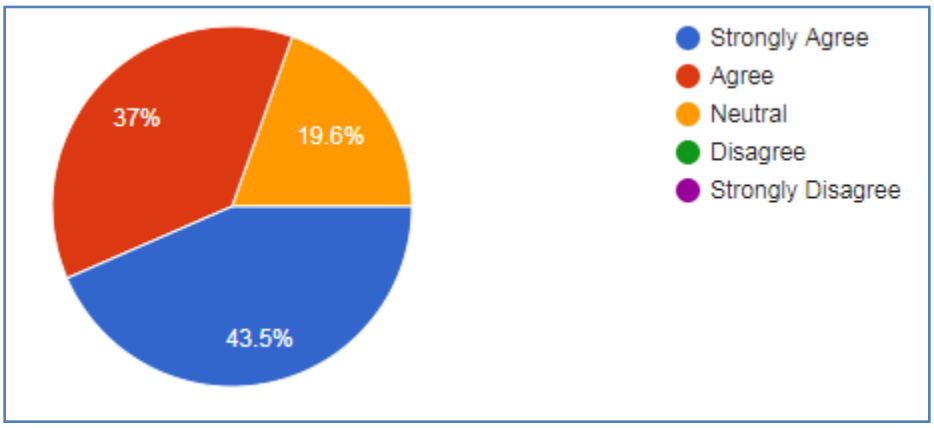

Figure 5: Independent use of AT

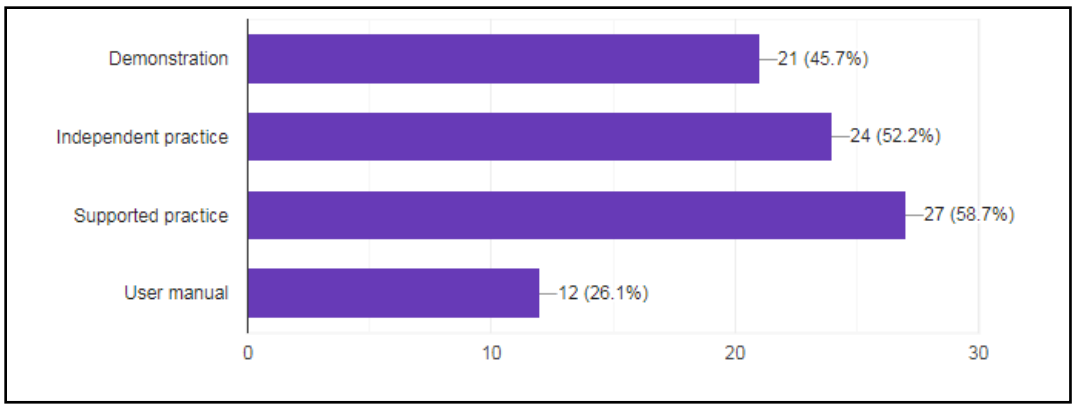

Figure 6: Form of Training Preferred

Respondents were further asked an open-ended question on strategies to ensure effective utilisation of AT and responses are summarised in Table 4. Suggestions by respondents revolved around the training of personnel involved in AT service provision; increased user training on working with screen readers to access electronic resources; addressing the availability of adequate AT devices which can be used outside the campus; use of mobile applications and increased user engagement.

Table 4: Strategies to increase usage of AT

Theme	Count	Explanation
Training of AT personnel	16	Personnel who work with special needs students should be adequately trained and stay current with different kinds of AT
Increased user training	11	Students require more advanced skills in navigating and accessing electronic content using screen readers
Increasing AT equipment	10	Students need more laptops installed with JAWS/NVDA to borrow and work at home or in halls of residence

Funding for AT products	10	More funding options should be availed to increase the availability of AT products. For example, some respondents suggested that scholarship funding for students with special needs should include aspects of AT products.
Latest AT products	8	Students with special needs require the latest gadgets that are fast because they are already behind
Use of mobile devices	8	Mobile devices with accessibility features and text-to-speech applications can be used as AT.
More user engagement	6	Respondents expressed the need to engage them more through meetings

Discussion of Results

The results revealed that most respondents accessed AT devices through UZ Library facilities. This demonstrates that the Library plays a key role in facilitating the accessibility and usage of AT by students with special needs at UZ. Other studies have also shown that most students in university settings gain access to AT through library facilities (McNicholl et al., 2021; Tripathi & Shukla, 2014). This is particularly important given that access to AT is still a big challenge in most developing countries due to a myriad of factors which include lack of adequate funding, lack of relevant legislation or policies, and lack of suitably trained AT personnel (Harniss et al., 2016; Khasnabis et al., 2015; Munyoro et al., 2021; Tangcharoensathien et al., 2018). The unmet need for AT is still high in Southern Africa (Matter & Eide, 2018), with only 15-25 per cent of students with special needs who need AT having access to it (Matter et al., 2016). Making AT available

and accessible in higher education institutions is therefore very critical to address the needs of many students who are not able to purchase the devices on their own.

The respondents in this study used AT in various ways. The study proved that AT provides freedom by allowing respondents to complete academic activities that they were previously unable to do; ranging from studying, reading, writing, researching, web browsing, emailing, communication with lecturers, note-taking, communication with peers about academic work, to preparing for examinations. Therefore, the main function of AT in higher education is to enable students with special needs to perform academic tasks, which is very critical for academic achievement. AT makes it possible to eliminate some of the existing barriers that make the learning environment and learning materials inaccessible for students with special needs (Simui et al., 2018).

AT provision strives to guarantee that a person with a disability who may require AT receives and benefits from the AT solution (de Witte et al., 2018). Respondents in this study confirmed that several benefits are derived from the use of AT in academic settings. The study found that AT makes it easy for students with special needs to carry out academic activities more effectively and access academic information related to their courses. Also, respondents confirmed that using AT can lead to increased social interaction, self-confidence, and peer-to-peer engagement. The results support the assertion that AT devices are primarily used to "increase, maintain, or improve functional capacities of persons with disabilities," as well as to promote independence and engagement (World Health Organisation, 2011). Therefore, AT promotes academic engagement and social interaction among students with special needs.

Training, among other elements, remains a key component for ensuring effective utilisation of AT by students. This entails effective training of both AT providers as well as end-users using various delivery methods. In agreement with study respondents, literature shows that many crucial components are required for successful AT usage, and these include increasing the availability of AT products, improving end-user knowledge and engagement, proper policy/legislation, collaboration, funding and the availability of skilled personnel (Holloway et al., 2018; Khasnabis et al., 2015).

Conclusions

The study found that access to AT by students with special needs at the University of Zimbabwe is primarily through Library facilities. It is therefore critical to make AT affordable for higher education institutions to satisfy the needs of many students with special needs who cannot afford to acquire the devices on their own. To make this happen, the university must spearhead the development of AT experts and foster the local production of appropriate AT devices through the Faculty of Education or a new faculty. Also, there is a need to negotiate with the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development to make AT more affordable.

The study demonstrated that AT promotes freedom by helping students with special needs to execute previously impossible academic tasks. Results showed that AT makes it easier for students with special needs to carry out academic activities and access academic material relevant to their courses. It was confirmed that utilising AT can boost social interaction, self-confidence, and participation. The study concludes that AT enhances academic engagement and social interaction among students with special needs.

To optimise AT usage, UZ Library can partner with AT specialists to provide training in digital accessibility concepts for personnel to increase awareness of the user requirements for students with special needs. This can enhance the university's ability to provide content in accessible formats compatible with common AT devices. The university must negotiate with the parent ministry to make AT more affordable, promote the local manufacturing of appropriate AT devices and foster the development of AT experts in the teaching of students with special needs. The study also recommends public-private partnerships to increase AT funding options, increase user engagement, and embrace low-cost AT products. Further research using specific academic performance outcomes may be necessary to find results based on more objective data.

REFERENCES

Ahmad, F. K. (2015). Use of assistive technology in inclusive education : Making room for diverse learning needs. *Transcience*, *6*(2), 62–77. https://www2.hu-berlin.de/transcience/Vol6_No2_62_77.pdf

Borg, J., Larsson, S., Östergren, P. O., Rahman, A. A., Bari, N., & Khan, A. N. (2012). Assistive technology use and human rights enjoyment: A cross-sectional study in Bangladesh. *BMC International Health and Human Rights*, *12*(1). https://doi.org/10.1186/1472-698X-12-18

Burgstahler, S. (2003). The role of technology in preparing youth with disabilities for postsecondary education and employment. *Journal of Special Education Technology*, *18*(4), 7–19. https://doi.org/10.1177/016264340301800401

Clouder, L., Cawston, J., Wimpenny, K., Mehanna, A. K. A., Hdouch, Y., Raissouni, I., & Selmaoui, K. (2019). The role of assistive technology in renegotiating the inclusion of students with disabilities in higher education in North Africa. *Studies in Higher Education*, *44*(8), 1344–1357. https://doi.org/10.1080/03075079.2018.1437721

de Witte, L., Steel, E., Gupta, S., Ramos, V., & Roentgen, U. (2018). *Assistive Technology Assistive technology provision: towards an international framework for assuring availability and accessibility of affordable high-quality assistive technology*. https://doi.org/10.1080/17483107.2018.1470264

Dziva, C., Shoko, M., & Zvobgo, E. F. (2018). Implementation of the 2006 Convention on the Rights of Persons with Disabilities in Zimbabwe: A review. *African Journal of Disability*, *7*, 1–7. https://doi.org/10.4102/ajod.v7i0.389

Gill, J., Johnson, P., & Clarke, M. (2010). *Research methods for managers*. Sage Publications.

Green, J. L. (2018). *Assistive Technology special education: Resources to support literacy, communication, and learning differences* (3rd ed.). Prufrock Press.

Green, R. A., & Blair, V. (2011). *Keep it simple: A Guide to assistive technologies*. Libraries Unlimited.

Gronlund, A., Lim, N., & Larsson, H. (2010). Effective use of assistive technologies for inclusive education in developing countries : Issues and challenges from two case studies. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, *6*(4), 5–26. https://doi.org/10.1080/09687599.2011.543862

Harniss, M., Raja, D. S., & Matter, B. (2016). Assistive Technology access and service delivery in resource-limited environments: Introduction to a special issue of Disability and Rehabilitation: Assistive Technology. *Disability and Rehabilitation. Assistive Technology*, *10*(4), 268–270. https://doi.org/10.3109/17483107.2015.1039607

Holloway, C., Austin, V., Barbareschi, G., Ramos Barajas, F., Pannell, L., Morgado Ramirez, D., Frost, R., McKinnon, I., Holmes, C., Frazer, R., Kett, M., Groce, N., Carew, M., Abu Alghaib, O., Khasnabis, C., Tebbutt, E., Kobayashi, E., & Seghers, F. (2018). *Scoping research report on assistive technology: On the road for universal asistive technology coverage*. https://www.disabilityinnovation.com/uploads/images/AT-Scoping-Report_2019-compressed-19.pdf

Kendall, L. (2016). Higher education and disability: Exploring student experiences. *Cogent Education*, *3*(1). https://doi.org/10.1080/2331186X.2016.1256142

Khasnabis, C., Mirza, Z., & MacLachlan, M. (2015). Opening the GATE to inclusion for people with disabilities. *The Lancet, December*. https://doi.org/10.1016/S0140-6736

Kusekwa, L., Munyoro, J., & Chikonzo, C. (2016). Partnerships for broadening access to information: the case of University of Zimbabwe Library. *Satellite Meeting – Africa Section. Building Cross Cultural Capacities for Universal Access to Information and Knowledge in Africa. Dates: 11-12 August 2016. Location: Ohio University, Athens, Ohio, USA*, 1–12. http://creativecommons.org/licenses/by/4.0

Lack, R., Ball, S., Kujenga, A., & Chimuka, Y. (2013). Increasing library usage through Free Open Source Software (FOSS) Solutions: Two Case Studies from Zimbabwe. *Journal of Library Innovation*, *4*(2), 42-undefined.

Majoko, T. (2018). Participation in higher education: Voices of students with disabilities. *Cogent Education*, *5*(1), 1–17. https://doi.org/10.1080/2331186X.2018.1542761

Majoko, T. (2019). Inclusion of children with disabilities in physical education in Zimbabwean primary schools. *SAGE Open*, *9*(1–16). https://doi.org/10.1177/2158244018820387

Malcolm, M. P., & Roll, M. C. (2017). The impact of assistive technology services in post-secondary education for students with disabilities: Intervention outcomes, use-profiles, and user-experiences. *Assistive Technology*, *29*(2), 91–98. https://doi.org/10.1080/10400435.2016.1214932

Maor, D., Currie, J., & Drewry, R. (2011). The effectiveness of assistive technologies for children with special needs : a review of research- based studies needs. *European Journal of Special Needs Education ISSN:*, *26*(3). https://doi.org/10.1080/08856257.2011.593821

Marasinghe, K. M., Lapitan, J. M., & Ross, A. (2015). Assistive technologies for ageing populations in six low-income and middle-income countries: A systematic review. *BMJ Innovations*, *1*(4), 182–195. https://doi.org/10.1136/bmjinnov-2015-000065

Matter, R. A., & Eide, A. H. (2018). Access to assistive Technology in two Southern African countries. *BMC Health Services Research*, *18*(1), 1–10. https://doi.org/10.1186/s12913-018-3605-9

Matter, R., Harniss, M., Oderud, T., Borg, J., & Eide, A. H. (2016). Assistive technology in resource-limited environments: A scoping review. *Disability and Rehabilitation: Assistive Technology*, *12*(2), 1–10. https://doi.org/10.1080/17483107.2016.1188170

McNicholl, A., Casey, H., Desmond, D., & Gallagher, P. (2021). The impact of assistive technology use for students with disabilities in higher education: a systematic review. *Disability and Rehabilitation: Assistive Technology*, *16*(2), 130–143. https://doi.org/10.1080/17483107.2019.1642395

Ministry of Public Service Labour and Social Welfare. (2021). *National disability policy [Zimbabwe]*. Ministry of Public Service, Labour and Social Welfare.

Moriña, A. (2017). Inclusive education in higher education: challenges and opportunities. *European Journal of Special Needs Education*, *32*(1), 3–17. https://doi.org/10.1080/08856257.2016.1254964

Munyoro, J., Machimbidza, T., & Mutula, S. (2021). Examining key strategies for building assistive technology (AT) competence of academic library personnel at university libraries in Midlands and Harare provinces in Zimbabwe. *Journal of Academic Librarianship*, *47*(4), 1–

9. https://doi.org/10.1016/j.acalib.2021.102364

Pomputius, A. (2020). Assistive technology and software to support accessibility. *Medical Reference Services Quarterly*, *39*(2), 203–210. https://doi.org/10.1080/02763869.2020.1744380

Sibanda, P. (2018). A review of the implementation of inclusive education in Zimbabwe: challenges and opportunities. *Scientific Journal of Pure and Applied Sciences*, *7*(9), 808–815. https://doi.org/10.14196/sjpas.v7i9.2554

Simui, F., Kasonde-Ngandu, S., Cheyeka, A. M., Simwinga, J., & Ndhlovu, D. (2018). Enablers and disablers to academic success of students with visual impairment: A 10-year literature disclosure, 2007-2017. *British Journal of Visual Impairment*, *36*(2), 163–174. https://doi.org/10.1177/0264619617739932

Taherdoost, H. (2016). Sampling methods in research methodology ; How to choose a sampling technique for research. *International Journal of Academic Research in Management (IJARM)*, *5*(2), 18–27.

Tangcharoensathien, V., Witthayapipopsakul, W., Viriyathorn, S., & Patcharanarumol, W. (2018). Improving access to assistive technologies: Challenges and solutions in Low- and Middle-Income Countries. *WHO South-East Asia Journal of Public Health*, *7*(2), 84–89. https://doi.org/10.4103/2224-3151.239419

Tebbutt, E., Brodmann, R., Borg, J., MacLachlan, M., Khasnabis, C., & Horvath, R. (2016). Assistive products and the Sustainable Development Goals (SDGs). *Globalization and Health*, *12*(79), 1–6. https://doi.org/10.1186/s12992-016-0220-6

Tripathi, M., & Shukla, A. (2014). Use of assistive technologies in academic libraries: A survey. *Assistive Technology*, *26*(2), 105–118. https://doi.org/10.1080/10400435.2013.853329

World Health Organisation. (2011). *World report on disability*. World Health Organisation. https://doi.org/http://www.who.int/disabilities/world_report/2011/report/en/

Yilmaz, K. (2013). Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European Journal of Education*, *48*(2), 311–325. https://doi.org/10.1111/ejed.12014