Chapter 18
Innovations and Use of Assistive Technologies in Libraries of Institutions of Higher Learning

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ABSTRACT

Access to information for all is a major component of library and information science in this digital era. Libraries in institutions of higher learning are mandated to provide information to all the patrons regardless of their ability to deal with the issue of inclusivity and social justice. A study on the innovations was conducted specifically for patrons with special needs in academic libraries. Different assistive technological types of equipment were outlined as well as the challenges encountered when using the assistive technology tools and applications. The observation was done at one of the academic libraries, and it was discovered that the library has a disability center that is used by patrons with special needs and manned by a trained librarian. The authors recommend the introduction of such services in all the academic libraries to cater to patrons with special needs.

INTRODUCTION

Inclusivity is now regarded highly in institutions of higher learning since libraries are mandated to provide useful information to all the patrons regardless of ability. Clients with different abilities are being enrolled for different programmes in educational institutions including those with low visual impairments, totally blindness, physical impairments, and hearing impairments. These patrons should be given equal opportunities to learn and access information resources in spite of their special needs. Libraries therefore are required to embrace the latest innovations in the form of assistive technologies to enhance

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library services to different clientele in institutions of higher learning. This chapter outlines innovations and use of assistive technologies in institutions of higher learning to ensure patrons with various needs have met their academic endeavours just like their other counterparts. The chapter sought to answer the following objectives: to outline different assistive technological equipment that are found in academic libraries, assess the effectiveness of assistive technology tools used in libraries in institutions of higher learning, and discuss the opportunities and challenges of using assistive technologies in libraries of institutions of higher learning.

BACKGROUND TO THE STUDY

The concept of inclusivity is understood as a way of minimizing or eliminating of barriers to students who participate in traditional settings (i.e., schools, homes, communities, libraries and workplaces) and the maximization of resources to support learning and participation in communities. (Mpofu 2004). In institutions of Higher learning and Library settings, inclusivity results in students' with various needs being able to partake courses that needs practical, such as, mathematics, sciences, and statistics. Innovations such as the development of assistive technologies empower people with special to understand and enhance learning and knowledge skills that are required in education and their areas of study. According to (Mpofu 2004) In Zimbabwe, there is no specific legislation of inclusive education although government policy issues are consistent with the intent of inclusive education. As such, innovations in technology have seen students with specific needs being embraced and considered in institutions of higher learning. Such students with unique or special needs, such as, those with low vision, totally blindness and those who are physically challenged are now able to partake science courses with the aid of assistive technological Innovations that will be outlined in the chapter. Assistive technology seeks to enhance the liberty to independent learning which this chapter seeks to evaluate the innovations in minimizing the barrier to effective teaching and learning of students with special needs in institutions of higher learning. With this background the writers seek to observe the use of assistive technological tools in narrowing the gap between the traditional teaching and learning concept and the use of assistive technology.

DEFINITION OF ASSISTIVE TECHNOLOGIES

Assistive technology is a set of devices intended to help people who have disabilities (Goddard 2004, Lloyd, Quist, and Wendt 2011, Dell, Newton & Petroff 2012, Sunaman & Kumar 2014, Tripathi & Shukla 2014, Green 2018). They are also known as adaptive technologies (American Library Association 2021) and these are electronic solutions that help people with special needs to live and learn independently. These tools are used to perform functions that might be difficult or impossible (University of Washington 2021). Many assistive devices are built using artificial intelligence (AI) technologies, including real-time speech-to-text transcription and visual recognition tools to overcome barriers associated with reading print, using computer workstations, taking notes and communicating with others both in the print and electronic environment (Brophy & Craven 2007). These include mobile devices such as walkers and wheelchairs, and software, hardware and peripheral devices that are used by people with special needs to access computers and other information technologies. People with limited hand function can use a keyboard with large keys or a special mouse in order to operate a computer, while those who are blind

can use special software which can read text on the screen using a computer generated voice. In terms of low vision, people can use software that enlarges screen content, people with speech impairment can use devices that speaks out loud while they enter the text via a keyboard, and people who are deaf can use text telephone (University of Washington 2021). Therefore, assistive or adaptive technologies are "products, devices, or equipments that are used to maintain, increase or improve the functional capabilities of people with disabilities" (Koulikourdi 2008: 387). Assistive technologies can be computer software, screen readers, and communication programs (Sensory Solutions 2017).

IMPORTANCE OF ASSISTIVE TECHNOLOGIES

It has been stated that access to information is a human right which allows people to develop themselves and actively participate in a democratic society (Todaro, 2005). Assistive technologies provide an opportunity for access to information for all be it in a print or electronic environment by increasing mobility, hearing, vision or communication capabilities (World Health Organisation 2021). Since they range from low to high-tech, assistive technologies can be used to support learning and to by-pass a challenging task and in most cases, they should be embedded within quality instruction (Young & MacCormack 2014). There are a number of software that are used in academic libraries to assist patrons with special needs to achieve their learning goals and objectives. These are text-to-speech, speech-to-text, visual aids, audio aids, physical aids, word prediction, and graphic organisers. "Books for all" is the first law of library science which shows that every patron should be able to access information resources in the library (Jinendran 2017). This is another way of enhancing and ensuring access to all regardless of ability.

Students with visual impairment or physical limitations that prevent them from typing on a keyboard can use text-to-speech devices to write their assignments such as Dragon Naturally Speaking (Guder 2012, TeachThought 2021). These devices are used by speaking into a microphone which translates the words into a typed document. Kurzweil 3000 is an example of text-to-speech software that read aloud digital or printed text. Patrons can understand unfamiliar words when they are read to them having a positive effect on decoding and word recognition and reading fluency and reading comprehension (Stodden, Roberts, Takahishi, Park, & Stodden 2012). Text-to-speech is important to students who take more information through listening than reading, and can assist students with monitoring and revising their typed work and identifying grammatical errors within the write up. Strangman & Dalton (2005) indicated that the text-to-speech software help to improve students' sight reading and decoding abilities. The software also assists those with difficulties in hearing letter-sounds by improving the reading comprehension (Holmes & Silvestri 2009). Students would have confidence in their work since they would be able to write expressively thereby decreasing the negative emotions associated with reading (Chiang & Jacobs, Young 2012).

This is useful to patrons with visual impairments since it allows them to listen to the text that would be appearing on a screen of a computer (TeachThought 2021). This is an improvement of braille since it can read anything on a computer screen once it is installed. It can read all formats be it a portable document format or a website without waiting for a Braille translation. Therefore, patrons can participate in online activities, and can easily access course materials and use email using software such as Natural readers. Screen magnifying software is used to enlarge portions of the screen by pointing the mouse to assist those with visual impairment. Audio aids are sound amplification tools, alerting devices that use flash lights or icons on the computer screen, phones enabled with voice carry-over technologies,

and close captioning for videos also known as telecommunication for the deaf. As a result, there are equal opportunities for all patrons in accessing information since the tools assist in overcoming various limitations and obstacles faced in any environment (Jinendran 2017). Assistive technologies have managed to deal with the digital divide between those with special needs and those without by providing information on computers.

In light of this, academic libraries should have assistive technologies because people need help. Many people with special needs are not able to keep up with technological changes while some cannot afford to own the tools. These patrons are benefiting from using the technologies in their libraries to learn and do research. Academic libraries, therefore, create awareness to patrons with special needs on the existence of various assistive technology tools and applications and assist them on how to use them. Patrons are exposed state of the art and research based solutions which assist in improving the quality of life of people with special needs thereby creating opportunities and removing barriers so that people of all ages and abilities can explore new possibilities (Green 2018). A summary of the benefits of assistive technology was provided by Green (2018:21) as "save time; motivate and engage users; make tasks easier and more enjoyable; have real-life value; support unique learning styles, abilities and backgrounds; provide feature flexibility and customisability at a level previously impossible; facilitate positive outcomes by carefully controlling tasks; give independent, non-judgemental, immediate feedback; promote effective independent practice; streamline data and information collection; enable users to create, store, and access documents and resources from multiple locations; provide opportunities to objectively document change over time; increase opportunities for socialisation and reduce isolation; enhance lifelong learning; provide more effective studying and learning strategies; and empower users to collaborate online".

PATRONS WITH SPECIAL NEEDS

Patrons with special needs are defined as individuals with a mental, emotional, or physical disability. An individual with special needs may need help with: communication, movement, and self-care. According to the Convention on the Rights of Persons with Disabilities of the United Nations. Article 24 of 2020 (United Nations 2020) which states that in realizing the right to equal opportunities, States Parties shall ensure that:

1. Persons with disabilities are not excluded from the general education system on the basis of disability, and that children with disabilities are not excluded from free and compulsory primary education, or from secondary education, on the basis of disability;
2. Persons with disabilities can access an inclusive, quality and free primary education and secondary education on an equal basis with others in the communities in which they live;
3. Reasonable accommodation of the individual's requirements is provided;
4. Persons with disabilities receive the support required, within the general education system, to facilitate their effective education;
5. Effective individualized support measures are provided in environments that maximize academic and social development, consistent with the goal of full inclusion.

As the world comes to the realisation that persons with disabilities need to be accommodated in all spheres of life the adaptation of Assistive Technology is the only relevant innovation to be embraced

so that special people can have easy access to education and relevant information, (American Library Association 2021)

ROLE OF ASSISTIVE TECHNOLOGY IN INFORMATION ACCESS

Access to information for all is regarded as one of the basic human rights which should be enjoyed by every citizen in a country. Among the laws of librarians, there is also emphasis to the need to provide information to all the patrons without discrimination. This shows that it is the responsibility of libraries to make their services and collections accessible irrespective of race, colour, or disability (Ayiah 2017). The five laws of libraries by Ranganathan state that books are for use (maximise the use of book), every reader his book (reader is the prime factor and his/her need must be satisfied), every book its reader (find a reader for every book), save the time of the reader (organise information in such a way that the reader finds the wanted information promptly), and a library is a growing organism (emphasis is on comprehensive and evolutionary growth). Therefore, assistive technology provides an opportunity for patrons with special needs to be able to access information resources in both the print and electronic environment (Koulikourdi 2008, Sanaman & Kumar 2014). Patrons with special needs are empowered by the use assistive technologies to connect to various people regardless of location (Baker, Hanson & Myhill 2009).

The advent of information communication technologies and assistive technologies had played a big role in reducing the digital divide between the sighted and the blind since everyone can now access information using computers (Koganuramath & Chowkimath 2009). However, in order to ensure that there is equitable access to information resources in academic libraries, library staff should be highly knowledgeable in information technology and computing to create innovative ways of applying assistive technologies. Berkeley. Kressin and Oberlander (2007) stated that the library staff assisting patrons with special needs should know the needs of the students and then work towards providing solutions to keep up with the ever changing technologies.

All the library services and products should be available to all patrons served by the academic library. In order to improve access to information, patrons with special needs should be able to access all the electronic resources, both open access and commercial ones, the online public access catalogue (OPAC), and Microsoft office. Tripathi & Shukla (2014) emphasised the provision of reading materials in all formats like braille, large font books, talking books, and electronic books. They also noted the importance of making the library website and OPAC accessible to patrons with special needs. The Web Accessibility Initiative (Web Accessibility Initiative 2005) specified that academic libraries should ensure that all the patrons are able to access their web site. Academic libraries can make use of consortia to share resources and staff and build strong partnerships with organisations that work with people with special needs to ensure that they access all the library resources (Tripathi 2013).

ASSISTIVE TECHNOLOGY TOOLS

There are various tools that are used in academic libraries to assist students with special needs in their research and learning processes. The tools can be grouped into no-tech, low-tech, and high-tech as shown in table 1. These tools assist patrons with visual and hearing impairments, and learning differences.

Table 1. Examples of assistive technology

No-tech	Low-Tech	Hi-tech
• Pencil grip • Post-it notes • Slanted surfaces • Raised lined paper • Covered overlays • Tactile letters • Magnifying bars • Weighted pencils	• Buzzers • Portable word processors • Talking calculator • MP3 players • Electronic organisers • Switches • Lights	• E-readers • Touch screen devices • Computerised testing • Speech recognition software • Word processors • Text-to-speech • Progress monitoring software

Table 1 show that an academic library can have assistive technologies ranging from magnifying glasses to sophisticated computer workstations with software to scan a book and read it aloud. The available technologies must be meeting the specific needs of the patrons such as the provision of software for recognising speech for patrons with visual impairment to enable them to control the computer or to input text through speech. Touch screens and electronic tracking devices can be provided to patrons who cannot use a standard keyboard (Sanaman & Kumar 2014). The workstation for patrons with special needs must be adjustable so that patrons would be able to work with the height they are comfortable with on worktables. There should also be a movable arm to place the monitor to allow the tilting of the display as required. A keyboard tray and large monitor allows patrons to see more clearly using the software that enlarge the screen when reading (Mates 2010).

Figure 1. Assistive technology tools

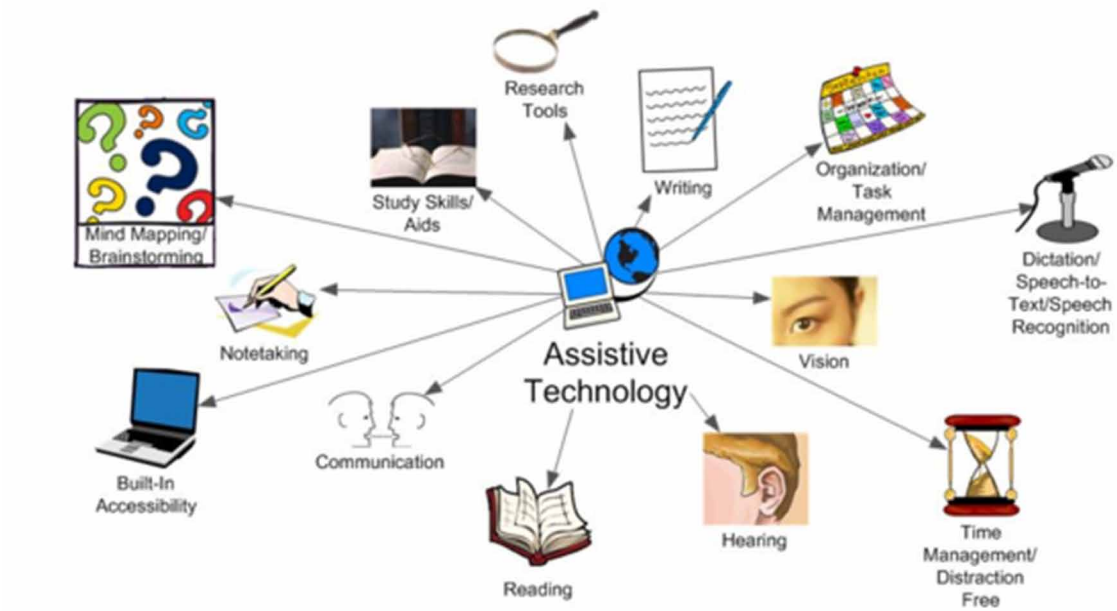

Figure one shows the various assistive technology tools that can be utilised by academic libraries to help patrons with special needs to successfully complete their education endeavours. It has been suggested that academic libraries should have assistive technology centres with a computer laboratory equipped with various software and a talking book studio (Tripathi & Shukla 2014, Subramaniam, Oxley & Kodama 2013, Burgstahler 2011, Cummings 2011, Ennis-Cole & Smith 2011, Krueger & Stefanich 2011, Socol 2010, Farmer 2009, Hopkins 2006, Neal & Ehlert 2006). The major recommended software are:

- Enlarging or magnifying software,
- Screen reading software,
- Kurzweil 1000,
- Talking typing pro,
- Math scanning and reading software,
- Tactile view graphic software,
- Tactile drawing boards,
- Tactipad drawing tablet,
- Math window,
- Tactile graphic image library,
- Graphic aid for mathematics,
- JAWS talking software for the blind,
- VP arithmetic,
- Scientific calculator with speech,
- Scientific calculator for low vision, and
- Geometric set in Braille.

Hardware and Software Solutions for People With Visual Impairments

Patrons with low vision cannot read standard written materials since they appear too small and sometimes blurry. In order to deal with these challenges, libraries should have large print books, hand-outs, signs, and equipment labels. There are specialised hardware and software programs that enlarge displays on the monitor and some can read materials to users, while some allow speech input. Patrons with visual impairments can be assisted using the following hardware and software solutions (American Library Association 2021):

1. ZoomText Xtra screen-magnification software which allow patrons with low vision to use the computer through screen display enlargement.
2. JAWS screen reader which enables patrons to access information through voice output.
3. Open Book text reader which scans printed text and verbalizes the text.
4. Duxbury braille translating software which allows users to type text and translate it into Braille. It works like a word processor leading to the production of a hardcopy through a braille embosser.
5. Braille embosser which works like a printer to print Grade II Braille on paper so that patrons can create hard copies of the documents. Patrons can also save the documents to a USB flash drive.
6. Talking typer software which is a typing teacher program for those who have low vision. It provides audio instruction and tutorials.

7. Systems that employ a video camera lens to enlarge text such as closed-circuit television magnifiers, handheld magnifiers, signature guides, and felt-tip pens.

Assisting Patrons With Hearing Impairments

In most cases, patrons who have hearing impairments do not have challenges in using the computer itself but will have difficulties when using websites with audio cues. There is need to provide assistive technologies to help patrons so that they make use of the information resources that are available in the library. Patrons with hearing impairments can use the following:

1. Sound sentry which allows users to see embedded warning chimes of Microsoft products as flashes since they cannot hear them.
2. Instant messaging which allow patrons and staff to talk to each other through typing and sending messages.

Assisting Patrons With Learning Differences

There is need to provide a safe studying and learning environment for patrons with physical disabilities so that they are able to do tasks using a computer, for, example, patrons on wheelchair need a sturdy and safe workstation for them to accomplish their tasks. The following should be put into place:

1. Table height and monitor position should be adjustable. This would assist those with different needs to suit their special requirements when using the workstation.
2. Special input devices should be available e.g. trackballs, joysticks, switches, touch pads and augmented keyboards such as micro keyboards or oversize keyboards with enlarged keys.
3. Madentec tracker which uses a camera or tracker to manipulate the cursor through head movement. A user wears a tiny reflective dot on the forehead or glasses.
4. Softype which is a software utility that replaces the functionality of a standard keyboard with a full-featured onscreen keyboard.

Use of Assistive Technologies in Academic Libraries

Assistive devices and technologies according to (UNESCO, 2020) are those devices whose primary purpose is to maintain or improve an individual's functioning and independence to facilitate participation and to enhance overall well-being. They can also help prevent impairments and secondary health conditions. Assistive technologies (ATs) are prefaces of the term that refers to assistive, adaptive rehabilitative devices, products, or equipment for helping people with disabilities. These improve, increase and maintain the functional capabilities of persons with disabilities. ATs assist individuals in communication, education, work, and recreation; help them achieve greater independence; and enhance quality of life. Assistive technologies offer independence by enabling people with disabilities to perform tasks which they were traditionally unable to accomplish such as calculations and hearing impairments. ATs can immensely improve the quality of life of individuals with disabilities by providing better access to information, knowledge, education, healthcare, and employment. (UNESCO, 2020).

CHALLENGES OF USING ASSISTIVE TECHNOLOGY

Academic libraries face various challenges in using assistive technologies to assist patrons with special needs. There is a challenge that technology is ever changing and it is key for academic libraries to keep up with the changes to avoid the problem of technology obsolescence. Applications and tools that are available today may not be accessible tomorrow due to technological changes leading to hardware and software failure (Green 2018). Academic libraries therefore, should keep pace with the changes to ensure that patrons with special needs continue to benefit from these services.

Due to the various applications and tools available, there is a challenge that is faced by librarians when they try to make their libraries accessible to patrons with special needs. There are too many choices available on the market and librarians may get stuck in the technological mud (Sanaman & Kumar 2014). Some academic librarians do not have the technical expertise which is very important in the selection of appropriate equipment. Librarians are encouraged to consult bibliographical sources that document problems encountered by other libraries in providing technological equipment in the form of assistive technologies (Jacobsen 2012). This will assist the librarians during the decision making process on choosing the right equipment for the patrons with special needs. There are guidelines in most academic libraries of how to deploy assistive technologies.

Assistive technology tools and applications can be very expensive to acquire. Due to the limited library budgets, some academic libraries are not able to buy the hardware and software to make the resources available to patrons with special needs. In order to deal with this challenge, libraries can take advantage of the open source software and other free resources that are available on the internet. Academic libraries can also form consortia to share resources by developing a union catalogue so that the resources available in other libraries can be easily located, shared, accessed and used using the inter library loan services (Tripathi 2013, Tripathi & Shukla 2014).

There are some challenges that are associated with the actual use of assistive technologies which can be detrimental to users. These include but are not limited to the effects of excess use of various screens to read, technology addiction, and the effects of technology on brain function (Green 2018). Academic libraries should maximise the use of these assistive technologies while minimising the harm that it can cause. This can be done by educating the patrons on the dangers of excessive use of technology. It is the duty of the librarian to protect patrons with special needs from the harmful effects of technology while exposing them to the benefits. There is also a challenge on the accessibility of the equipment beyond library operating hours when the physical library is closed. Most of the patrons cannot afford to own the tools and applications at their homes and they solely rely on the assistive technologies in libraries. This shows that librarians should extend their operating hours to accommodate more patrons with special needs. This would help in maximising the use of the assistive technology tools and applications in academic libraries to have value for money.

METHODOLOGY

A survey was conducted to assess what is available in terms of assistive technology in academic institutions to achieve academic goals. A literature review and web content analysis was done to unpack the assistive technologies that are used in libraries in academic institutions to cater for patrons with special needs. An observation was done in one of the academic libraries in Zimbabwe (Institution A) to iden-

tify the assistive technology tools that are used to assist patrons with special needs. One institution was chosen as it was the pioneer in offering assistive technologies to patrons with disabilities and it has a well-established disability centre. The library has a disability centre which is specifically reserved for patrons with special needs to access information resources and to write examinations. Content analysis was used to analyse the results which were presented thematically.

FINDINGS

The library at Institution A continues to make efforts to eliminate digital barriers of access to information by users with special needs since 2018 graduation. Building upon an assortment of assistive devices that were acquired some time in 2014, the Library acquired new tools and upgrade software to keep pace with technological changes and user needs. The new assistive products that were acquired are: Blaze ET, Sensory Portable Book Reader Recorder with WIFI, and an upgraded JAWS version as displayed in table 2.

Table 2. Assistive technologies available at institution A

Category	Specific Item	Purpose	QTY
OCR Scan & Read	Blaze ET	To capture and read aloud hard copy printed documents converting it from text-to-speech. The book sense can take a picture and store it while a patron is reading.	20
Book Readers & Voice Recorders	Sensory PBRW	Hardware device that allow a user to playback digital audio books, voice recordings and text files.	8
Screen Reading Software	JAWS (Job Access with Speech)	Screen reader to convert electronic text to speech on a monitor.	8 licenses

Merlin Ultra Desktop Magnifier: Solution for Low Vision

Merlin Ultra Desktop Magnifier facilitates improved viewing and reading of text images captured from physical books or print materials. It enables individuals with low vision to read, write, view photos, in colour, black-and-white or enhanced high-contrast positive or negative viewing modes. The solution provides easy to use buttons and provision for setting favourable colour combinations for both text and background, and for changing image sizes as well as viewing modes for easier visibility.

Ruby Handheld Electronic Magnifier: Solution for Low Vision

This is a portable video magnifying device that provides powerful on-the-go magnification to enable low vision persons to read print materials. The device assists in dealing with the challenge experience by patrons with visual impairment and this promote equal access to information.

Figure 2. Merlin ultra desktop

Figure 3. Ruby handheld electronic magnifier

Book Sense/Recorder: Solution for the Blind

The Book Sense is a portable digital audio device which can play digital books, audio files, text files, and DAISY content. You can use the built-in digital recorder to record various items, such as lectures, music from the FM radio, and even record from external audio sources using the line-in mode. The Book Sense device would also be used to play back the information from print format that would have been converted to mp3 format using the Open Book and Portable Reading Camera.

Open Book and Portable Pearl Reading Camera: Solution for the Blind and Low Vision

The PEARL combined with OpenBook brings blind and low vision users instant portable access to printed material with an array of human-sounding voices. The Pearl is a folding camera which is connected to a PC and snaps a picture of printed reading material. OpenBook is the software that makes the

text accessible on the PC screen, and reads it aloud. The Book Sense device used by the students who are visually impaired or who are totally blind.

Figure 4. Book sense/recorder

Figure 5. Open book and portable pearl reading camera

Magic Screen Magnification: Solution for the Low Vision

MAGic screen magnification software increases the size of text image on a monitor to allow low vision persons to access and use computers. This is a powerful device that is used with patrons with low vision to read electronic resources which are the main information resources in this information communication technology era.

Figure 6. Magic screen magnification

Sci Plus 300 Talking Scientific Calculator

Two talking calculators were purchased for use by students who may need to use them for their statistics and other mathematical-related courses. Patrons are admitted to any programme of their choice regardless of ability. As a result, patrons with visual impairment benefit from the services provided by the talking calculator to do their calculations during lectures and when writing examinations. The visual barriers are broken by the use of the talking scientific calculator.

Job Access With Speech (JAWS)

A computer screen Reader that allows blind and visually impaired users to read the screen either with text to speech output or by a Refreshable Braille display. This is a software that is used by students who are totally blind. This is a screen reading software that reads the text displayed on the computer screen with a speech synthesizer or braille display. The software plays an interface role between the blind or low vision user and the computer's operating system or applications. The software makes it possible for the visually impaired users to send commands by pressing different keys on the computer keyboard and receives voice feedback. It has enabled the blind and low vision to use computers without using a mouse

to perform a number of tasks such as researching, typing, and communicating. Patrons with special needs are inducted on the use of the software and many students have benefited so far from using JAWS. These devices have helped students to improve their grades as well as widened their opportunities on the Job market and enhanced their independents.

Figure 7. Sci Plus 300 talking scientific calculator

Figure 8. Index braille box, V4 braille embosser and braille stapler

Index Braille Box, V4 Braille Embosser and Braille Stapler For Binding Braille Documents and Other Auxiliary Accessories

State-of-the-art high-speed braille equipment can work in conjunction with Open Book and Pearl Reading Camera to convert printed material to braille. To enable this translation, Duxbury Braille Translation software (DBT) should be installed. This is software that works together with the Braille equipment.

Opportunities of Using Assistive Technologies

The survey revealed that from the period between 2014 and 2020 students who are constantly using assistive technologies have heard opportunities to do the following:

- Independence and autonomy, both for the person and those around them. In Zimbabwe, Institutions of higher learning especially institution A, embraced assistive technology devices as a way of empowering students with special needs to access information and knowledge.
- Assistive technologies facilitate memory and recall specifically the book-sense and the Blaze they help students to store and recall recorded information as well as book reading.
- The gadgets help to manage potential risks in and around the home.
- Reduces boredom on special people and improves educational performance.
- Reduce the stress on carers, improving their quality of life, and of the person they are caring for.

Challenges of Using Assistive Technologies

The following are the barriers that were found when this research was being undertaken:

- Inappropriate staff training and support.
- negative attitudes towards students with special needs,
- Inadequate assessment and planning processes, the devices are donor funded therefore, they provide devices without assessing to proper needs.
- Insufficient funding, difficulties procuring and managing equipment, and time constraints

IMPACT OF NEWLY ADDED ASSISTIVE PRODUCTS

Blaze ET is an optical character recognition (OCR) scan and read device that capture and reads aloud hard copy printed documents converting the text into speech. The device is useful to persons who are blind or with low vision, as it allows them to read, listen to and enlarge material that would otherwise be inaccessible. Blaze ET has made it possible for the blind and visually impaired to access information in various formats as it has the capability to read and play a variety of files including TXT, MP3, MP4, HTML, DOC, DOCX and PDF. In addition, Blaze ET has an in-built WIFI which makes it possible for users to access online e-books and other online material.

Sensory PBRW is a hardware device that allows a user to playback digital audio books, music, voice recordings and text files. It is user-friendly for the blind and low vision users as it offers voice feedback and large tactile buttons. It is very useful for users who need to record lectures, meetings and discussions. Information recorded can be stored to the device's internal memory and memory card. It has high quality recording capability which facilitates good quality audio recording of lectures. Patrons with special needs can store their information on storage devices for easy accessibility.

SOLUTIONS AND RECOMMENDATIONS

The study supports the importance of interactive nature of assistive technologies and the independence that comes with the technology. Impairment factors with the assistance of assistive technologies enhance the social welfare of learners and people around them as such it is plausible to recommend suitable assistive technologies to narrow the gap between persons with special needs and those without. People with mobility and sight limitations are vulnerable in some instances. The most significant factor for

recommending assistive technologies brings confidence and stability in patrons with special needs. The interaction between different factors determines the most effective institutions and workplaces, which brings up effectiveness and efficiency in organisations as well as communities. It is recommended that all institutions of Higher learning should have support systems to cater for various needs of their patrons.

New technological solutions have improved the accessibility of information by patrons with special needs. This means that academic libraries should make the necessary arrangements to ensure that the assistive technologies are accessible for the benefit of patrons with special needs. There is need to build capacity among the librarians in order to assist the patrons when using these devices. Library staff should be aware of the available tools and should have the skills of how to use them and also be in a position to interact with patrons with special needs. There is need for staff to learn about disability etiquette when working with patrons with special needs.

There is need to create awareness of the services that are offered to patrons with special needs in academic libraries. Academic libraries should organise orientation programs for patrons with special needs to educate them on using the various software for their educational purposes. Librarians and patrons with special needs should also be aware of the various pieces of legislation and standards that stipulate what is expected of academic libraries when dealing with patrons with special needs. These include but are not limited to accessible library buildings with ramps, elevators, and adaptable toilets. Patrons with special needs should also be assisted in retrieving information and their loan periods should be extended for them to benefit from the library services and products.

Library budgets should be crafted in such a way that assistive technology tools are made available to patrons with special needs to enable electronic access to information for all patrons. The library can develop a plan that allows the acquisition of the essential tools to assist patrons. Some of the libraries do not have spaces and assistive technologies to cater for patrons with special needs. This can be attributed to lack of awareness or unfamiliarity to accessibility concepts with regard to patrons with special needs.

There is also a general lack of funds to buy the assistive technologies which are regarded as expensive. Librarians should make use of open educational resources and free online programs and facilities that cater for patrons with special needs. Academic libraries can also collaborate with other libraries and organisations that offer services for patrons with special needs at national, regional and international level. All stakeholders including the government, universities, libraries and other organisations should work together to provide the much needed assistive technologies to support patrons with special needs when looking for information.

Academic libraries should be accommodative when it comes to serving patrons with special needs. Library staff should provide directional assistance and general orientation to the building as well as clear signage within the library to guide the patrons on where they can find the assistive technologies. This can include visual, colour coded diagrams of resources and services that are offered by the library.

FUTURE RESEARCH DIRECTIONS

A study on the experience of patrons in using these assistive technologies can be done to understand how they are benefiting from these devices as well as their perception towards the effectiveness of the tools and applications in meeting their research and learning needs. There is also need to do a study on the skills of academic librarians in dealing with patrons with special needs in service provision.

CONCLUSION

It can be noted that, assistive technologies had been handy in academic libraries in ensuring access to information for all. People with visual impairments are able to hear computer-screen text and enlarging the text on the screen to allow independent reading. Computers help in lowering many barriers that might be faced with patrons with special needs in accessing information both in the print and electronic environment. It is important for library staff to understand that patrons with special needs are not the same and they should be treated as individuals. Therefore, the library staff should be trained on how to deal with patrons with special needs. Academic libraries should provide an enabling environment to meet the information needs of all the patrons including those with special needs.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence: It is the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions.

Assistive Technology: Devices and services that are used to increase, maintain, or improve the capabilities of people with a disability.

Disability: Any physical impairment that may hinder day to day functioning of an individual and require dependence on others.

Hearing Impairment: Hearing loss which can be permanent or fluctuating that adversely affect a person's educational performance.

Innovation: Introduction of something new that creates value.

Institutions of Higher Learning: It is a college, university, technical, or business school offering post-secondary level academic instruction leading to the award of a certificate, diploma, or degree.

JAWS: It stands for Job Access With Speech which is a screen reader software used to navigate computer applications using keystrokes. The software converts text into speech or braille and can be used with Microsoft Suite, Adobe Acrobat Reader, Internet explorer, and Firefox.

Optical Character Recognition: It is the electronic or mechanical conversion of images of typed, handwritten or printed text into machine coded text.

Visual Impairment: It is any kind of vision loss, whether it is not seeing at all or having partial vision loss.

Web Accessibility: The ability to perceive, understand, navigate, interact with, and contribute to the web by people with special needs. This help in providing equal access and opportunity to people with disabilities.