ASSISTIVE TECHNOLOGIES AND TOOLS USED BY VISUALLY IMPAIRED STUDENTS FOR THE UTILIZATION OF INFORMATION RESOURCES IN FEDERAL UNIVERSITY LIBRARIES IN NIGERIA

By

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Abstract

This study surveyed the assistive technologies and tools used by visually impaired (VI) students to utilize information resources in federal university libraries in Nigeria. The specific objectives were to identify the assistive technologies and tools used by visually impaired students to utilize information resources in the universities studied and to examine the challenges faced by visually impaired students in acquiring information literacy skills and utilizing information resources in the universities studied. The study adopted a descriptive survey design based on a quantitative research approach. The population comprised 220 visually impaired students across federal universities in Nigeria. Census sampling was used to include the entire population in the study. A questionnaire was used as the instrument for data collection. The collected data were analysed using descriptive statistics. The findings revealed that the assistive technologies used by visually impaired students for the utilization of information resources included screen readers, screen magnifiers, touch screens, Braille displays, text-to-speech converter software, speech recognition software, Braille translation software, talking assistive devices, and accessible mobile applications. The findings also revealed several challenges, including lack of awareness and familiarity with library information resources, negative attitudes of staff and students without disabilities, inconsistent electricity supply, lack of sustainable personal devices, inadequate information literacy promotion and awareness programmes, inadequate assistive technologies, poor internet connectivity, lack of suitable internet-enabled resources, shortage of trained personnel, fear and insecurity, and social exclusion. The study concluded that although some assistive *technologies and tools are available in federal universities in Nigeria, their effective utilization is affected by numerous challenges. The study recommended that Nigerian universities should invest more in dedicated assistive technologies and facilities to improve service delivery to visually impaired students.*

Keywords: *Assistive technology, visually impaired students, federal universities, libraries, information resources, Nigeria.*

Introduction

Assistive technologies play a pivotal role in facilitating accessibility for visually impaired individuals in libraries. Assistive technology can be defined as any product or system that supports persons with disabilities to perform functions that they may otherwise find difficult. Such technologies address a variety of disabilities, including visual, hearing, physical, cognitive, and learning disabilities. For visually impaired persons, technologies such as screen readers, text-to-speech software, screen magnifiers, and refreshable Braille displays enable users to access and interact with printed and digital materials. These technologies convert visual information into alternative formats, thereby allowing users to perceive and engage with content more effectively.

A survey conducted on the use of assistive technologies in resource centres in Mumbai by Utekar and Kale (2023) reported that the types of assistive technologies available for utilization by visually impaired students included audiobooks 4 (100%), magnifiers 3 (75%), Braille literature 3 (75%), screen readers 2 (50%), and Braille embossers 1 (25%). The study recommended the integration of emerging technologies, such as artificial intelligence (AI) and virtual reality (VR), into assistive technologies for visually impaired individuals. Such integration could include AI-powered image-recognition systems and VR-based navigation aids to enhance accessibility and independence.

Mishra (2023) pointed out that training programmes for visually impaired users on the effective use of assistive technologies can empower them to independently access library resources and services. Accessibility in libraries for visually impaired individuals involves physical, digital, and technological considerations. By implementing inclusive practices and embracing assistive technologies, libraries can create an environment that promotes equal access and inclusivity for all users, regardless of their visual abilities.

Statement of the Problem

Visually impaired individuals can derive substantial benefits from assistive technologies. These technologies help create a level playing field between persons with visual impairments and users without disabilities. By enabling access to content for various purposes, including education, employment, social interaction, and entertainment, assistive technologies contribute to a more inclusive and equitable environment. Some of the major benefits of assistive technologies for visually impaired persons include improved access to information, increased independence, enhanced communication, educational and employment opportunities, and social inclusion.

Despite these benefits, visually impaired students in Nigerian federal universities continue to encounter persistent barriers in the utilization of assistive technologies and tools for accessing information resources in their respective libraries. Many students experience a mismatch between their impairment-specific needs, the assistive technologies and tools available, and the information resources provided. Library collections remain largely dominated by inaccessible print resources, with limited provision of alternative formats such as Braille, large-print materials, tactile graphics, and audiobooks. Where digital platforms and academic databases are available, they may not be fully compatible with assistive technologies such as screen readers or refreshable Braille displays, thereby restricting access to critical learning resources (Udonte, 2025).

It is against this background that the present study examines the assistive technologies and tools used by visually impaired students to utilize information resources in Nigerian federal universities. The study also examines the challenges faced by visually impaired students

in acquiring information literacy skills and utilizing information resources in the universities studied.

Research Objectives

The general objective of the study was to examine the assistive technologies and tools used by visually impaired students for the utilization of information resources in federal university libraries in Nigeria. Specifically, the study sought to:

1. identify the assistive technologies and tools used by visually impaired students for the utilization of information resources in the federal universities under study; and
2. examine the challenges faced by visually impaired students in acquiring information literacy skills and utilizing information resources in the universities under study.

Review of Related Literature

Assistive Technologies Used by Visually Impaired Students

Assistive technologies have significantly transformed the lives of persons with disabilities. These technologies are developed to address the needs of people with different forms of disabilities and to promote their overall development and participation in society. Various technologies have been developed to support the information, navigation, educational, recreational, and social needs of visually impaired persons. Some of these technologies include the following:

1. Visual Imagery Systems

Vision-based navigation or optical navigation uses computer-vision algorithms and optical sensors, including different types of cameras, to extract visual features from the surrounding environment. The system detects obstacles using these visual features and guides the user to navigate safely by providing directions and alerts to avoid obstacles. Different visual-imagery-based devices and technologies have been incorporated into navigation systems, including stereo cameras, IP camera networks, and RGB-D cameras. These systems can be categorized according to the underlying visual-imaging capture device or technology.

2. Systems with 3D Sound

The Sound of Vision system is a wearable sensory-substitution device designed to assist visually impaired persons in navigating their surroundings. It creates and conveys an auditory and tactile representation of the surrounding environment, thereby providing users with both audio and haptic feedback.

3. Screen Readers

A screen reader is a software programme that works in conjunction with a speech synthesizer to provide verbal descriptions of information displayed on a computer or mobile-device screen, including menus, text, and punctuation. It provides persons with visual impairments with direct access to digital information. Screen readers also promote independence by enabling visually impaired persons to read information at their own pace without requiring assistance from another person.

4. Braille Embosser

A Braille embosser is a specialized printer that converts computer-generated text into Braille by embossing raised dots onto paper.

5. Closed-Circuit Television

Closed-circuit television (CCTV) systems for visually impaired persons magnify printed materials through a special television camera equipped with a zoom lens and display the enlarged image on a monitor.

6. Large-Print Materials

Large-print materials are documents produced using enlarged fonts for users with partial sight. They enable partially sighted users to read printed information more easily. Although considerable literature exists on the types of assistive technologies available for visually impaired students, much of the existing research

has been conducted in developed countries, with limited evidence describing the situation in Africa and Nigeria in particular. The present study therefore seeks to contribute to addressing this gap by examining the assistive technologies and tools used by visually impaired students in Nigerian federal universities.

Challenges Associated with the Acquisition of Information Literacy Skills by Visually Impaired Students

Visually impaired students face several challenges in acquiring information literacy skills and utilizing information resources. These challenges include lack of awareness and familiarity with library information resources, attitudes of staff and students without disabilities, inadequate understanding of the organization of information resources, inadequate knowledge of information retrieval tools, inadequate library and information literacy skills, schedule conflicts and time constraints, inconsistent electricity supply, lack of sustainable personal devices, inadequate information literacy promotion and awareness programmes, inadequate assistive technologies, poor internet connectivity, lack of suitable resources with internet access, shortage of trained personnel, fear and insecurity, and social exclusion.

The attitude of personnel responsible for addressing the information needs of persons with visual impairments is a critical issue that requires attention. In agreement with this, Otyola et al. (2017) found that some lecturers who teach visually impaired students are inadequately trained to teach and support students with special needs. Similarly, Athanasios et al. (2019) identified lack of equipment and infrastructure, inadequate numbers of trained teachers, social exclusion and prejudice against visually impaired persons, lack of motivation, and fear and insecurity about failure as challenges associated with the acquisition of information literacy skills by visually impaired students. These inadequacies remain significant concerns across many educational institutions in Nigeria and beyond. Providing the necessary infrastructure to guarantee access to information for all users, irrespective of their physical status, is essential for addressing social exclusion and prejudice against persons with visual impairments.

Furthermore, Eyinade and Bakare (2022) examined the challenges faced by visually impaired students while acquiring information. Their findings revealed that the challenges included poor attitudes of library staff towards visually impaired students (mean = 2.91, SD = 0.781), limited numbers of documents in Braille and audio formats (mean = 2.82, SD = 0.890), lack of computers with screen-reader software (mean = 2.97, SD = 0.706), lack of training (mean = 2.34, SD = 0.905), and difficulty listening to materials transcribed from print to audio format (mean = 2.05, SD = 0.481).

Similarly, Chigbu and Nwafor (2017), in their study of the challenges associated with the acquisition of information literacy skills by visually impaired students for effective access to information at the University of Nigeria, Nsukka (UNN), found that poor power supply and lack of technically skilled volunteer staff significantly hindered the acquisition of information literacy skills, with mean ratings of 3.8 and 3.4, respectively. This was followed by lack of dedicated computers for visually impaired students in the library (mean = 3.3) and poverty among students (mean = 3.2). Other challenges identified included the lukewarm attitude of visually impaired students (mean = 3.2), lack of internet connectivity, and lack of computers dedicated to visually impaired students in the library. During the interview sessions, the students confirmed these challenges as factors affecting their acquisition of information literacy skills.

Methodology

The study adopted a quantitative research approach using a descriptive survey design. The population comprised all 220 visually impaired students in federal universities in Nigeria. Census sampling was used to include the entire population in the study. A questionnaire was used as the instrument for data collection. The instrument was validated and recorded a reliability index of 0.875. The questionnaire was administered by the researchers with the assistance of research assistants. The collected data were analysed using descriptive statistics.

Results and Findings

Research Question One: What are the assistive technologies used in the utilization of information resources by visually impaired students?

Table 1 presents the responses of visually impaired students regarding the assistive technologies used to utilize information resources.

Key: SA = Strongly Agree; A = Agree; U = Undecided; D = Disagree; SD = Strongly Disagree.

Table 1: Assistive Technologies Used for the Utilization of Information Resources by Visually Impaired Students

Items	SA F (%)	A F (%)	U F (%)	D F (%)	SD F (%)	X	Decision
Screen readers	73 (34.4%)	56 (26.4%)	16 (7.5%)	43 (20.3%)	23 (10.8%)	2.64	Accepted
Scanners (OCR)	28 (13.2%)	22 (10.4%)	11 (5.2%)	66 (31.1%)	84 (39.6%)	2.26	Rejected
Screen magnifiers	100 (47.2%)	43 (20.3%)	4 (1.9%)	54 (25.5%)	10 (4.7%)	3.80	Accepted
Touch screen	39 (18.4%)	84 (39.6%)	11 (5.2%)	31 (14.6%)	46 (21.7%)	2.68	Accepted
Braille displayer	64 (30.2%)	93 (43.9%)	0 (0.0%)	33 (15.6%)	21 (9.9%)	3.69	Accepted
Text or speech converter software	54 (25.5%)	81 (38.2%)	3 (1.4%)	32 (15.1%)	41 (19.3%)	3.36	Accepted
Speech recognition software	65 (30.7%)	72 (34.0%)	5 (2.4%)	34 (16.0%)	35 (16.5%)	3.46	Accepted
Braille translation software	73 (34.4%)	69 (32.5%)	16 (7.5%)	29 (13.7%)	24 (11.3%)	3.65	Accepted
Closed-circuit television	31 (14.6%)	20 (9.4%)	8 (3.8%)	71 (33.5%)	81 (38.2%)	2.28	Rejected
Talking assistive device	61 (28.8%)	79 (37.3%)	8 (3.8%)	34 (16.0%)	29 (13.7%)	3.52	Accepted
Accessible mobile applications	56 (26.4%)	92 (43.4%)	0 (0.0%)	40 (18.9%)	23 (10.8%)	3.56	Accepted

Decision rule = 3.0

Table 1 presents the responses of visually impaired students regarding the assistive technologies used to utilize information resources. The results show varying levels of agreement across the listed technologies.

For screen readers, 73 respondents (34.4%) strongly agreed and 56 respondents (26.4%) agreed, with a mean score of 2.64. For scanners (OCR), only 28 respondents (13.2%) strongly agreed and 22 respondents (10.4%) agreed, while 66 respondents (31.1%) disagreed and 84 respondents (39.6%) strongly disagreed, producing a mean score of 2.26. This indicates low utilization of scanners (OCR).

Regarding screen magnifiers, 100 respondents (47.2%) strongly agreed and 43 respondents (20.3%) agreed, with a mean score of 3.80, indicating a high level of utilization. For touch screens, 39 respondents (18.4%) strongly agreed and 84 respondents (39.6%) agreed, with a mean score of 2.68.

With respect to Braille displays, 64 respondents (30.2%) strongly agreed and 93 respondents (43.9%) agreed, with a mean score of 3.69, indicating a high level of utilization. Similarly, 54 respondents (25.5%) strongly agreed and 81 respondents (38.2%) agreed that they used text-to-speech converter software, with a mean score of 3.36.

For speech recognition software, such as Dragon NaturallySpeaking, 65 respondents (30.7%) strongly agreed and 72 respondents (34.0%) agreed, with a mean score of 3.46, indicating a generally high level of utilization. Similarly, 73 respondents (34.4%) strongly agreed and 69 respondents (32.5%) agreed that they used Braille translation software, with a mean score of 3.65.

However, for closed-circuit television, only 31 respondents (14.6%) strongly agreed and 20 respondents (9.4%) agreed, with a mean score of 2.28, indicating low utilization. For talking assistive devices, 61 respondents (28.8%) strongly agreed and 79 respondents (37.3%) agreed, with a mean score of 3.52, indicating a generally high level of utilization.

Finally, 56 respondents (26.4%) strongly agreed and 92 respondents (43.4%) agreed that they used accessible mobile applications, such as applications for reading e-books or navigating digital libraries. The mean score of 3.56 indicates a generally high level of utilization.

Overall, the findings indicate that the assistive technologies used by visually impaired students include screen readers, screen magnifiers, touch screens, Braille displays, text-to-speech converter software, speech recognition software, Braille translation software, talking assistive devices, and accessible mobile applications. However, scanners (OCR) and closed-circuit television recorded comparatively low levels of utilization.

Research Question Two: What are the challenges associated with the acquisition of information literacy skills and utilization of information resources by visually impaired students in the universities studied?

Table 2 presents the responses of visually impaired students regarding the challenges associated with the acquisition of information literacy skills.

Key: SA = Strongly Agree; A = Agree; U = Undecided; D = Disagree; SD = Strongly Disagree.

Table 2: Challenges Associated with the Acquisition of Information Literacy Skills by Students with Visual Impairment

Items	SA F (%)	A F (%)	U F (%)	D F (%)	SD F (%)	X	Decision
Lack of awareness and familiarity with library information resources	104 (49.1%)	46 (21.7%)	12 (5.7%)	14 (6.6%)	35 (16.5%)	3.81	Accepted
Attitudes of staff and students without disabilities	42 (19.8%)	33 (15.6%)	9 (4.2%)	92 (43.4%)	35 (16.5%)	2.79	Accepted
Inadequate understanding of the organization of information resources	106 (50.0%)	26 (12.3%)	4 (1.9%)	35 (16.5%)	40 (18.9%)	3.58	Accepted
Inadequate knowledge of retrieval tools for using information resources	40 (18.9%)	103 (48.6%)	7 (3.3%)	31 (14.6%)	30 (14.2%)	3.44	Accepted
Inadequate library and information literacy skills	48 (22.6%)	82 (38.7%)	7 (3.3%)	48 (22.6%)	26 (12.3%)	3.37	Accepted
Schedule conflicts/time constraints	68 (32.1%)	61 (28.8%)	15 (7.1%)	32 (15.1%)	35 (16.5%)	3.45	Accepted
Lack of consistent electricity supply	61 (28.8%)	84 (39.6%)	12 (5.7%)	28 (13.2%)	26 (12.3%)	3.60	Accepted
Lack of sustainable personal devices	57 (26.9%)	90 (42.5%)	6 (2.8%)	31 (14.6%)	27 (12.7%)	3.56	Accepted
Lack of information literacy promotion and awareness programmes	82 (38.7%)	36 (17.0%)	10 (4.7%)	39 (18.4%)	44 (20.8%)	3.35	Accepted
Inadequate assistive technologies	44 (20.8%)	73 (34.4%)	6 (2.8%)	59 (27.8%)	29 (13.7%)	2.58	Accepted
Lack of internet connectivity	53 (25.0%)	90 (42.5%)	7 (3.3%)	33 (15.6%)	28 (13.2%)	3.51	Accepted
Lack of suitable resources with internet access	91 (42.9%)	88 (41.5%)	0 (0.0%)	8 (3.8%)	24 (11.3%)	4.01	Accepted
Lack of trained personnel	76 (35.8%)	67 (31.6%)	4 (1.9%)	27 (12.7%)	37 (17.5%)	3.56	Accepted
Fear and insecurity	71 (33.5%)	56 (26.4%)	10 (4.7%)	32 (15.1%)	42 (19.8%)	3.39	Accepted
Social exclusion	40 (18.9%)	110 (51.9%)	2 (0.9%)	22 (10.4%)	37 (17.5%)	3.45	Accepted

Decision rule = 3.0

Table 2 presents the responses of visually impaired students regarding the challenges associated with acquiring information literacy skills.

The results reveal varying levels of agreement across the identified challenges.

Regarding lack of awareness and familiarity with library information resources, 104 respondents (49.1%) strongly agreed and 46 respondents (21.7%) agreed, producing a mean score of 3.81. This indicates that lack of awareness and familiarity with library information resources is a challenge faced by the students.

Regarding the attitudes of staff and students without disabilities, 42 respondents (19.8%) strongly agreed and 33 respondents (15.6%) agreed, with a mean score of 2.79. Inadequate understanding of the organization of information resources recorded a mean score of 3.58, with 106 respondents (50.0%) strongly agreeing and 26 respondents (12.3%) agreeing.

For inadequate knowledge of retrieval tools for using information resources, 40 respondents (18.9%) strongly agreed and 103 respondents (48.6%) agreed, producing a mean score of 3.44. Inadequate library and information literacy skills recorded a mean score of 3.37, with 48 respondents (22.6%) strongly agreeing and 82 respondents (38.7%) agreeing.

Regarding schedule conflicts and time constraints, 68 respondents (32.1%) strongly agreed and 61 respondents (28.8%) agreed, with a mean score of 3.45. Lack of consistent electricity supply recorded a mean score of 3.60, with 61 respondents (28.8%) strongly agreeing and 84 respondents (39.6%) agreeing. Similarly, lack of sustainable personal devices recorded a mean score of 3.56, with 57 respondents (26.9%) strongly agreeing and 90 respondents (42.5%) agreeing. Lack of information literacy promotion and awareness programmes recorded a mean score of 3.35.

Regarding inadequate assistive technologies, 44 respondents (20.8%) strongly agreed and 73 respondents (34.4%) agreed, with a mean score of 2.58. Lack of internet connectivity recorded a mean score of 3.51, with 53 respondents (25.0%) strongly agreeing and 90 respondents (42.5%) agreeing.

Lack of suitable resources with internet access recorded the highest mean score of 4.01, with 91 respondents (42.9%) strongly agreeing and 88 respondents (41.5%) agreeing. Lack of trained personnel recorded a mean score of 3.56, while fear and insecurity recorded a mean score of 3.39. Finally, social exclusion recorded a mean score of 3.45, with 40 respondents (18.9%) strongly agreeing and 110 respondents (51.9%) agreeing.

Overall, the findings indicate that visually impaired students encounter several challenges in acquiring information literacy skills and utilizing information resources. These include lack of awareness and familiarity with library information resources, attitudes of staff and students without disabilities, inadequate understanding of the organization of information resources, inadequate knowledge of information retrieval tools, inadequate library and information literacy skills, schedule conflicts and time constraints, inconsistent electricity supply, lack of sustainable personal devices, inadequate information literacy promotion and awareness programmes, inadequate assistive technologies, poor internet connectivity, lack of suitable resources with internet access, shortage of trained personnel, fear and insecurity, and social exclusion.

Conclusion

The study concludes that several assistive technologies and tools are used by visually impaired students for the utilization of information resources in the federal universities studied. These include screen readers, screen magnifiers, touch screens,

Braille displays, text-to-speech converter software, speech recognition software, Braille translation software, talking assistive devices, and accessible mobile applications. However, the utilization of some technologies, particularly scanners (OCR) and closed-circuit television, was relatively low.

The study further concludes that visually impaired students face several challenges that affect their acquisition of information literacy skills and utilization of information resources. These challenges include inadequate awareness of library information resources, limited understanding of information organization and retrieval tools, inadequate information literacy skills, inconsistent electricity supply, lack of personal devices, inadequate information literacy programmes, inadequate assistive technologies, poor internet connectivity, lack of suitable resources, shortage of trained personnel, fear and insecurity, and social exclusion.

Recommendations

In line with the findings of the study, the following recommendations are made to improve the assistive technologies and tools available to visually impaired students for the utilization of information resources in Nigerian universities:

1. Universities should establish and adequately equip dedicated assistive-technology centres with screen readers, screen-magnification software, touch-sensitive interfaces, Braille displays, text-to-speech and speech-recognition software, Braille translation applications, and talking assistive devices.
2. Assistive-technology centres should be staffed with trained technicians and library personnel, who can troubleshoot hardware and software problems, provide regular technical support, conduct orientation programmes, and offer step-by-step training for new users.
3. Universities should organize regular training and refresher workshops for visually impaired students and relevant library staff to ensure effective use of existing and emerging assistive technologies.
4. University libraries should ensure that electronic databases, institutional repositories, e-books, online catalogues, and other digital information resources are compatible with commonly used assistive technologies, particularly screen readers and Braille displays.
5. University authorities should provide reliable electricity and internet connectivity to assistive-technology centres and library facilities to ensure uninterrupted access to digital information resources.

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