

CHAPTER THIRTEEN

Empowering Visually Impaired Students: Developing Educational Assistive Technologies for Inclusion in the Nigerian University System

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Abstract

Students with visual impairments in Nigerian universities continue to encounter significant barriers to learning, including inaccessible educational materials, inadequate assistive technologies, insufficient institutional support, and limited educator preparedness for inclusive teaching. This paper presented a conceptual framework for promoting educational inclusion through the development of localised assistive technologies, accessible learning resources, educator capacity-building, and institutional policy reform. Drawing on Inclusive Education Theory, the Social Model of Disability, Universal Design for Learning (UDL), and the Capability Approach, the paper proposed an integrated model to enhance access to higher education for students with visual impairments. Central to the framework is EVISVision, an assistive mobile learning application designed to support independent access to educational content through text-to-speech, optical character recognition, voice navigation, and offline functionality. The framework also emphasised the conversion of academic materials into Braille, audio, large-print, and screen-reader-compatible formats, as well as systematic staff training and policy implementation. The paper contributed to the ongoing discourse on inclusive higher education and offered practical recommendations for advancing Sustainable Development Goals 4 and 10 through equitable access to quality university education in Nigeria.

Keywords: Inclusive Education, Assistive Technologies, Accessibility, Policy Reform.

Introduction

Inclusive education is an educational approach that identifies and removes barriers to learning, ensuring all students, regardless of ability or background, can learn together effectively (UNESCO, 2025). In Nigeria, as in many countries, inclusive education has gained prominence as a strategy to provide quality education for all and to address disparities in access. Visually impaired students represent a significant group that faces unique challenges in higher education. Visual impairment ranges from low vision to total blindness, affecting a person's ability to read standard print or navigate visual materials (Garcia, 2024). Globally, the scale of visual impairment is substantial, at least 90 million children worldwide live with some form of vision loss or blindness and Nigeria is no exception (89up, n.d.). An estimated 4.25 million Nigerians over age 40 have moderate to severe visual impairment or blindness, indicating the magnitude of need for accessible learning solutions (Dineen et al., 2006). Visual impairments can drastically impede students' educational experience by limiting their access to textbooks, lecture presentations, and other visual learning resources.

The push for inclusion is grounded in fundamental rights and international development agendas. Sustainable Development Goal (SDG) 4 calls for inclusive and equitable quality education and lifelong learning opportunities for all, explicitly including persons with disabilities in its targets (United Nations, n.d.). Similarly, SDG 10 aims to reduce inequalities by empowering and promoting the social inclusion of all, irrespective of disability status (Casey, 2020). Nigeria has affirmed these goals by adopting policies aligned with the UN Convention on the Rights of Persons with Disabilities (CRPD). For example, a 2017 national policy defines inclusive education as "the process of addressing all barriers and providing access to quality education to meet the diverse needs of all learners in the same environment" (UNESCO, 2020). In practice, however, many Nigerian students with disabilities remain excluded or struggle within universities, due to insufficient accommodations and support (UNESCO, 2020). This gap between policy and reality highlights the need for concrete interventions.

Assistive technologies and educator training are key strategies to bridge this gap. Modern digital tools have transformed how students learn, and assistive technology (AT) can be life-changing for those with visual impairments.

Research confirms that AT can significantly increase the inclusion and accessibility of students with disabilities in education (Fernández-Batanero et al., 2022). Screen readers, text-to-speech software, electronic Braille displays, and other innovations allow visually impaired learners to access information and participate more equally. Yet, studies also show that significant barriers persist - notably a lack of teacher training in using inclusive strategies and technologies, limited information about available AT, and infrastructural or accessibility challenges (Fernández-Batanero et al., 2022). In Nigeria's universities, many lecturers have never received formal training on inclusive education techniques, and assistive devices or materials are often scarce. Even well-intentioned inclusion policies cannot succeed without knowledgeable educators or available tools.

This paper addressed these challenges by focusing on four interconnected priorities: developing assistive learning technologies tailored to visually impaired students, training educators in inclusive pedagogy, adapting academic materials into accessible formats, and advocating for supportive institutional policies. The project aimed at creating an enabling environment that empowers visually impaired students by addressing technological and human factors. These efforts directly support SDG 4's mandate of inclusive education and SDG 10's call to reduce inequalities, helping ensure that a visual impairment is not a barrier to university success. The main goal of this paper is to provide a comprehensive plan for fostering an inclusive Nigerian university system where visually impaired students can thrive alongside their sighted peers.

Conceptual Framework

Inclusive Education Theory

Inclusive education theory posits that schools and universities should accommodate all learners by eliminating barriers and providing support in regular education settings. Rather than segregating students with disabilities, the inclusive model strives to modify the environment and teaching practices to suit diverse needs. According to UNESCO, inclusive education involves "reinforcing the capacity of education systems to welcome and reach out to all learners" (UNESCO IIEP, n.d.). It covers everything from adapting curricula and pedagogy to training teachers and redesigning physical spaces (UNESCO, 2025). In the Nigerian context, inclusive education is a key strategy for

achieving SDG 4 and ensuring equitable education. National policy now frames inclusion as addressing all barriers (physical, informational, attitudinal) that impede any learner (UNESCO, 2020). This theory guides the project's holistic approach – rather than expecting visually impaired students to “fit” into an unaccommodating system, the system must change. All components of the university environment (course materials, teaching methods, infrastructure, policy) should be made accessible. The emphasis is on equal participation: visually impaired students learning alongside sighted peers, with appropriate supports in place. By grounding the project in inclusive education principles, we aim to foster an academic culture that respects diversity and provides “the same opportunities to participate in society as their peers” for students with disabilities (Fernández-Batanero et al., 2022).

Social Model of Disability

This project is also informed by the social model of disability, which distinguishes between an individual's impairment and the disabling barriers imposed by society. Under the social model, people are *not* disabled by their medical condition per se, but by external obstacles – e.g. inaccessible buildings, lack of assistive tools, or prejudiced attitudes (Disability Equality in Education, n.d.). In other words, disability is a product of the interaction between individuals and their environment. A visually impaired student has a functional vision limitation, but whether that becomes a “disability” in education depends on social arrangements. A rigid curriculum that assumes all students can read standard print, or a library without screen-reading software, creates disability by preventing that student from fully participating (Disability Equality in Education, n.d.). The social model calls for removing these barriers to create equality and offer disabled people more independence, choice and control (Disability Equality in Education, n.d.). Applying this lens, the project focuses on fixing the environment – providing assistive technology, accessible materials, and inclusive teaching – rather than “fixing” the student. For example, if a textbook is only available in regular print, a blind student is disabled by that format; but converting the book to Braille or audio removes the barrier, and the student can learn on equal footing. The social model of disability thus underpins our advocacy for institutional policy: universities must change policies and allocate resources to accommodate diverse needs. It also fights the stigma that “disabled people cannot do certain

things” by demonstrating that with the proper support, visually impaired students can excel (Disability Equality in Education, n.d.). Embracing this model, the project treats accessibility and inclusion as collective responsibilities of the university system.

Universal Design for Learning (UDL)

Universal Design for Learning (UDL) is a framework that translates inclusive education into practical instructional design. Originating from architecture’s universal design concept, UDL asserts that educational materials and methods should be designed from the outset to accommodate a wide range of learners, rather than retrofitting accommodations later. Sharma et al. (2023, p.34) defined UDL as “an educational framework that aims to create inclusive learning environments by providing multiple means of representation, action and expression, and engagement for all students, regardless of their learning styles, abilities, or disabilities.” UDL encourages teachers to present information in various ways (visual, auditory, tactile), allows students multiple ways to demonstrate knowledge, and uses diverse strategies to engage and motivate. By proactively removing learning barriers and offering flexibility, UDL reduces the need for individual special accommodations (Sharma et al., 2023). This project incorporates UDL principles in training educators and adapting curricula. For instance, converting materials into Braille, audio, and high-contrast large print ensures multiple content representations, benefiting visually impaired students and others. Likewise, the EVISVision app with its voice navigation and text-to-speech features provides alternate means of accessing content and completing tasks. UDL also stresses an inclusive digital learning environment: our plan to create accessible e-books and screen-reader-friendly documents aligns with making the digital course space navigable to all. By guiding lecturers in UDL-based lesson planning (e.g. always describing visual aids orally, providing lecture notes ahead of time in accessible formats), we institutionalise inclusive practices. Consequently, UDL serves as a design checklist to ensure all project outputs – whether a piece of software, a teaching guide, or an assessment method – are as usable by the broadest range of students. This contributes to sustainable inclusion beyond the project’s direct beneficiaries.

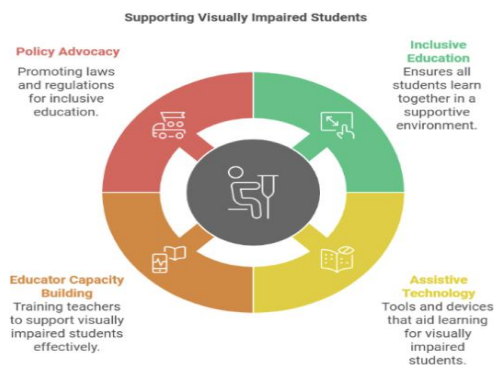
Capability Approach

Another conceptual pillar for this project is Amartya Sen's Capability Approach, particularly regarding disability and education rights. The capability approach focuses on expanding what people can be and do – their substantive freedoms or “capabilities” – rather than just providing resources. In the context of persons with disabilities, this approach argues that true equality entails enabling individuals to achieve functionings they value (such as obtaining a university education or pursuing a career), not merely treating everyone equally. As Broderick (2018) noted, the capability approach “focuses on ensuring equality and developing human potential,” offering a way to move beyond traditional measures of educational equality that only count inputs or test scores (Broderick, 2018). Applying this to inclusive education, we ask: do visually impaired students have the capability to succeed in higher education equally? If a blind student has a right to education but cannot access textbooks or campuses lacking Braille materials, their freedom to learn is curtailed. The capability approach thus supports providing assistive technology, alternative formats, and supportive teaching as essential to expanding a student's freedoms. It aligns closely with Article 24 of the CRPD, which guarantees persons with disabilities the right to education and requires states to facilitate their “full development of human potential and sense of dignity and self-worth” (Broderick, 2018). By giving visually impaired students the tools (capabilities) to learn independently – e.g. an app to read any text aloud, or training that enables teachers to include them in class discussions – we enhance their agency and educational outcomes. This approach also informs our evaluation: success is measured by the extent to which students can perform academic tasks and participate in university life, rather than just the provision of equipment. The capability lens reinforces that quality education for disabled students is a matter of justice and empowerment, not charity. Therefore, each component of our project (technology, training, materials, policy) is aimed at removing conversion handicaps and unleashing the capabilities of visually impaired learners to achieve their academic and life goals.

Interconnection of Technology, Training, and Policy

Crucially, these frameworks are interconnected in practice – technology alone cannot foster inclusion without trained educators and supportive policies, and

vice versa. The conceptual model driving this project sees assistive technology development, educator capacity-building, and policy advocacy as synergistic strategies that must work together. For example, the social model and UDL indicate that simple introduction of an assistive device (screen-reading software) is insufficient if instructors do not know how to integrate it into teaching or if university rules do not mandate its availability. Likewise, teacher training on inclusive methods will have limited impact if appropriate tools or materials are not available to implement those methods. Thus, the project adopts a systems approach: technological solutions (EVISVision app, accessible format materials) are deployed alongside human solutions (training, disability support services) within an enabling institutional framework (policies and funding).



(Figure 1: Conceptual model linking assistive technology, educator training, and inclusive policy for empowering visually impaired students)

Figure 1 (conceptual diagram) illustrates this interplay: the visually impaired student is at the centre, surrounded by three support pillars – technology, pedagogy, and policy. *Technology* (such as the EVISVision app and Braille/audio textbooks) provides access; *teacher training* ensures the pedagogy adapts to include the student using those means; and *policy* provides the mandate and resources to sustain both the technology and inclusive practices across the institution. If any pillar is weak, inclusion may fail. Findings in the literature support this integrated approach. Fernández-Batanero et al. (2022) emphasise that while assistive technologies improve inclusion, barriers like insufficient teacher training and lack of information can undermine their effectiveness (Fernández-Batanero et al., 2022).

Correspondingly, a policy brief on inclusive education management in Nigeria found that improving inclusion requires adequate teacher training, provision of teaching resources, and strong policy support, including proper funding (Nwakudu & Oliobi, 2021). Our conceptual framework, therefore, treats the development of AT, educator training, and advocacy for institutional policy as three strands of a single braided rope – all necessary to pull the system towards true inclusion. This theory of change guides the research methodology and implementation plan described next.

Methodology

The project employed a mixed-methods research design combining qualitative and quantitative approaches to achieve the stated objectives. This comprehensive methodology was structured in several phases: Needs Assessment (Qualitative and quantitative), Development of Localised Assistive Technologies (Design Research), Pilot Testing and Evaluation (Mixed Methods), Policy Advocacy, and Stakeholder Engagement.

Throughout all phases, ethical consideration was paramount. Informed consent was obtained from all student and staff participants, with assurance of confidentiality and the right to withdraw from the study at any time. Research involving vulnerable populations (students with disabilities) were approved by institutional ethics committees and conducted in accordance with international ethical standards. Feedback loops were incorporated; and preliminary findings were shared with participants and stakeholders for validation (member checking), ensuring the research accurately represented their perspectives and needs.

Expected Outcomes

Deployment of the EVISVision Assistive Mobile Learning App

A fully functional mobile application (with companion desktop and web versions) will be launched and made available to students. The app, described below, will enable visually impaired learners to access digital content through text-to-speech and other features. We expect at least 100 visually impaired students to be actively using EVISVision by the end of the project's pilot phase, with expansion in subsequent semesters. The app will be open-sourced and freely available, allowing further adoption by other universities and integration of additional features over time.

Conversion of Academic Materials into Accessible Formats

At least 20 core textbooks and numerous course handouts across different disciplines will be adapted into Braille (both embossed and refreshable digital Braille), audio (narrated or text-to-speech MP3), large-print, and screen-reader-friendly electronic formats (such as accessible PDF, EPUB3 or DAISY books). This includes foundational texts in subjects like law, psychology, literature, and science, which were identified as high-priority by the student needs assessment. The converted materials will be catalogued in an Accessible Educational Materials (AEM) repository within each pilot institution's library, creating a lasting resource. For example, if a Political Science textbook in print is converted to Braille and audio, future blind students can readily obtain those formats without delay. By the end of the project, visually impaired students in the pilot universities should be able to access all their semester readings in at least one accessible format.

Enhanced Capacity of Educators and Staff (200+ trained)

Over 200 lecturers, instructors, and academic support staff will receive training in inclusive education practices and the use of assistive technologies. This includes those who attended our intensive workshops, plus additional faculty reached through departmental training sessions and online modules developed by the project. We anticipate a measurable improvement in educators' attitudes and self-efficacy regarding teaching students with disabilities. For instance, post-training surveys are expected to show significant gains in participants' confidence to adapt materials or utilise tools like screen readers. Each trained educator becomes an ambassador for inclusion within their faculty. In the long run, this growing cohort of sensitised and skilled staff will foster a more inclusive campus culture and ensure that gains are not lost when the project concludes.

Institutional Adoption of Inclusive Education Policies

A critical outcome is achieving institutional and policy changes that embed support for visually impaired students into the system's fabric. We aim to have at least a few partner universities formally adopt new policies or guidelines due to our advocacy. Examples include: establishing a Disability Services Unit on campus (with at least one staff coordinator appointed to assist students with special needs), including provisions for accessible infrastructure and materials in the university's strategic plan, or signing an

MOU with the project team/NGOs to continue providing assistive technology support after the grant period. At the national level, we seek acknowledgement of our model in policy discourse – for instance, influencing the Federal Ministry of Education to incorporate our training curriculum into national teacher training programmes, or securing budgetary commitments for assistive devices in tertiary institutions. Success would be indicated by concrete actions such as a government directive urging all universities to implement the 2017 Inclusive Education Policy and report on progress, or by additional funding streams (from government or donors) dedicated to scaling the project outcomes. Overall, the objective is to move from isolated interventions to institutionalised inclusion.

EVISVision: Assistive Mobile Learning App

One of the project's flagship innovations is the development of **EVISVision**, an assistive mobile learning application designed to support visually impaired students in Nigeria's university system. The name "EVISVision" stems from Empowering Visually Impaired Students through Vision technology, reflecting its core purpose of opening educational content to those without sight.

Purpose and Concept

EVISVision is a personal learning companion for visually impaired students, turning a standard smartphone into a multi-functional assistive device. The app addresses everyday challenging academic tasks for blind or low-vision learners, such as reading textbooks, scanning printed handouts, navigating campus information systems, and controlling digital interfaces, by providing seamless audio and tactile (via vibration or optional braille display) interactions. The overarching goal is to enable students to study and navigate educational materials independently, without always needing a human reader or aide. By leveraging the ubiquity of mobile phones, EVISVision offers a low-cost, portable solution that can be widely adopted. Importantly, it is localised to the Nigerian context: it supports Nigerian English accents and Pidgin (for text-to-speech and voice commands). It is tuned for the content Nigerian students encounter (for example, it can correctly pronounce local names or places in texts).

Key Features

Screen Reading & Text-to-Speech (TTS): The app can read aloud digital text content, such as e-books, PDFs, Word documents, or web pages. Students can load their lecture notes or digital textbooks into EVISVision, and the built-in TTS engine will convert the text to clear spoken audio in a natural-sounding voice. The reading speed, voice pitch, and language accent are adjustable. This feature transforms any electronic document into an audiobook on demand, enabling visually impaired students to listen to their study materials. For instance, a student can listen to a PDF article on their phone while commuting or revise lecture slides by having them narrated by the app. (This is akin to mainstream screen reader software on computers, but optimised for mobile and academic use.) The importance of such technology is well-documented – tools like screen readers have revolutionised access to information for blind individuals (Australian Disability & Community Education & Training Ltd, n.d.). EVISVision extends this to the mobile learning context.

Optical Character Recognition (OCR): A standout feature of EVISVision is its OCR capability, which allows users to convert printed text into speech. Using the phone's camera, a student can snap a photo of a printed page – e.g. a textbook, class handout, or library article – and the app will analyse the image to recognise the text and then read it aloud. This empowers students to access print materials not previously available in Braille or digital form. For example, if a professor distributes a paper handout in class, a visually impaired student can use EVISVision to scan and listen to it immediately, rather than waiting for a transcribed version. The app provides audio guidance for capturing images (e.g. it can speak prompts like “move camera to the left” to help the user position the page correctly, similar to features of the KNFB Reader) (Australian Disability & Community Education & Training Ltd, n.d.). The OCR feature, which works offline once the language pack is downloaded, is crucial in a developing context where internet access may be unreliable. By bridging the gap between physical print and digital audio, EVISVision significantly reduces dependence on sighted assistance for reading.

Voice-Controlled Navigation: EVISVision is built to be used *eyes-free*. Users can navigate the app's functions and device using voice commands or simple gestures, minimising the need to look at or precisely tap the screen

(which is difficult for blind users). The app recognises spoken commands for everyday actions – for instance, a student can say “open Biology textbook Chapter 3” or “search for Introduction to Economics in the library” and EVISVision will execute the command. It also has an interactive voice assistant mode to answer queries like “what are my reminders?” or “go to page 50.” Additionally, through integration with the phone’s accessibility services, EVISVision allows voice or gesture control of other apps (for example, controlling a slideshow or recording). This not only aids in app usage, but also helps with general smartphone accessibility for academic tasks. For instance, a student can dictate an SMS or email to a lecturer, or ask EVISVision to announce incoming notifications, ensuring they stay connected with class communications. The voice interface is crafted to understand Nigerian English accent and common phrasing, making it user-friendly for local students.

Multi-Platform Support (Android, iOS, Web): Recognising that students may have different devices, EVISVision is being developed for Android (the most common smartphone OS in Nigeria) and iOS, with a web-based version for use on laptops or library computers. The core functionality remains consistent across platforms. A student could use the phone app on the go and log into EVISVision on a computer in a campus ICT centre to access the same features (screen reading, etc.) on a larger screen or with a hardware braille display. Synchronisation features allow notes or bookmarks to be shared across devices. This cross-platform approach ensures no student is left out due to device type and allows integration into university computer labs.

Offline Functionality: Given unreliable internet connectivity in many regions and the cost of mobile data, EVISVision is designed to work predominantly offline. After initial installation and downloading of necessary language packs and libraries, features like OCR and TTS operate without needing the internet. Students can use the app in remote campus areas or at home without connectivity. Cloud-based features (such as backing up user notes or downloading additional voices) are optional. This offline-first design is a practical necessity in the Nigerian context and ensures the tool is accessible to students regardless of their connectivity situation.

Localisation and Academic Integration: The app includes features specifically for academic use: an academic calendar and reminder system

(students can receive spoken reminders of class times, assignment due dates, or exam schedules), a feature to navigate by headings or page numbers within textbooks easily, and compatibility with library systems (potentially allowing students to search their university's library catalogue via the app). By collaborating with university libraries, we aim for EVISVision to serve as a portal to accessible library resources eventually. Sustainability is also built by making the app open-source – the code and documentation are publicly available so that university IT departments or local tech communities can contribute to its maintenance and improvement. The project is working with campus tech clubs and international NGOs to build a community of developers who will keep EVISVision updated and free. The open-source nature also fosters ownership: Nigerian universities can customise the app (e.g. add specific course materials or modules) to best serve their students.

Sustainability and Support: For EVISVision to have a lasting impact, plans are in place for ongoing support. The app will be institutionalised through university adoption – we are advocating that partner universities formally endorse the app as a recommended learning aid for students with visual impairments. Ideally, each university would have an ICT officer or disability support staff trained in the app's use, who can assist new students in onboarding and handle any technical issues. We have also partnered with a Nigerian tech NGO focusing on accessibility; they have agreed to host the open-source project repository and coordinate volunteer contributions post-project. Moreover, we are exploring collaborations with corporate sponsors (such as telecom companies or tech firms) to fund future development or possibly bundle the app on devices provided to students. The goal is for EVISVision to continue evolving beyond the initial project, adding features like STEM equation reading, integrating with braille notetakers, or incorporating AI for smarter image descriptions, thereby continually empowering new cohorts of visually impaired students.

Textbook & Academic Material Conversion Process

In tandem with developing new technology, the project strongly emphasises converting and producing accessible academic materials. Accessible Educational Materials (AEM) are instructional resources reformatted or designed to be usable by the broadest range of student abilities (CAST, n.d.). For visually impaired students, the main formats of interest are Braille, audio,

large print, and navigable e-text. Our conversion process is designed to yield materials in all these formats, ensuring redundancy and preference matching (since students have varying needs and preferences – some may be fluent Braille readers, others prefer audio, etc.). The process involves collaboration among subject matter experts, assistive technology specialists, and professional transcribers. Key formats and steps include:

Braille (Digital and Embossed)

Braille remains a crucial medium for many blind scholars, especially for detailed reading and technical subjects (where spelling, punctuation, or notation is important). Our team uses Braille translation software to convert text into Grade 2 Braille code, followed by proofreading by certified Braille transcribers for accuracy. The output is provided in two ways: (1) Digital Braille files (Braille-ready files like BRF or BRL) which students can read using a refreshable Braille display or on a computer with Braille support, and (2) Embossed Braille hardcopies for key textbooks or materials, produced with a high-speed Braille embosser on durable paper. For example, if “Introduction to Economics” is a 300-page print textbook, it might become roughly 10 volumes of embossed Braille. We prioritise producing Braille for materials like math/statistics content, where tactile reading of equations or tables is beneficial. Braille production follows international and Nigerian Braille standards (BANA guidelines for literary Braille, Nemeth Code or UEB for mathematics as appropriate). Each pilot university’s resource centre will house a Braille library of commonly used texts by the project’s end. Even though Braille preparation is time-consuming, it is invaluable for building literacy and note-taking skills among blind students.

Audio Format (Synthetic and Human-Narrated)

We provide audio versions of materials to cater to students who learn best by listening. Our approach leverages high-quality text-to-speech conversion and human narration in some cases. Using the EVISVision TTS engine and other software, we generate audio files (MP3 or DAISY audio books) for textbooks and lecture notes. These automated readings are quick to produce and can be easily updated if the source text changes. We also employ human narrators to record audiobooks for particularly complex or narrative-heavy texts (for instance, literature readings or materials where tone is important). We partner with volunteer reader programs and radio/television voice artists to record

chapters of select texts in clear, expressive speech. All audio materials include structured navigation (e.g. the ability to skip by chapter or section, especially in DAISY format). Students can either listen through the EVISVision app or via any MP3 player. The audio format allows students to study while commuting or resting, and can be a less intensive way to absorb large volumes of text. It addresses the finding that assistive technology can help with reading and writing challenges, enabling students to engage with content in a mode that suits them (Okoye, 2024). The project expects to produce dozens of hours of instructional audio content, benefiting others with reading difficulties.

Large Print and High-Contrast Materials

We create large-print versions of documents for low-vision students (those with some usable vision but who need magnification). Using desktop publishing tools, we reformat textbooks or handouts into large font sizes (e.g. 18-24 point) with high-contrast colour schemes (typically white text on black background or black on pale yellow, depending on user preference). These are PDF files optimised for screen magnifiers or printed on paper for shorter handouts. We ensure that diagrams or images in the material are enlarged and clarified with good contrast. Large-print materials help partially sighted students who might find Braille unfamiliar and prefer to use their residual vision. Additionally, we encourage using tactile graphics where appropriate: diagrams, maps, or charts are reproduced using swell paper or embossed outline drawings so blind students can feel the shapes. While tactile graphic production is specialised, we have created a few (for example, a tactile diagram of the human anatomy for a biology course, or a raised-line graph for an economics course) as prototypes. We will train staff to produce more on demand. These efforts align with recommendations that accessible formats include not just text but also graphical information in tactile form (CAST, n.d.).

Screen-Reader Compatible Digital Files

Ensuring electronic documents are structured adequately for screen reader software is vital to our process. This includes producing EPUB3 or DAISY text versions of textbooks, which are essentially e-books with built-in accessibility. For instance, an EPUB3 file can contain headings, navigation landmarks, alt-text for images, and descriptions, allowing a blind student to jump to chapters or have figures described easily. DAISY (Digital Accessible

Information System) books provide a similar navigable structure, often used in specialised talking book libraries. We have converted materials into accessible Word and PDF formats, tagging headings, lists, tables, and adding descriptions to images so that commonly used screen readers (like NVDA or JAWS) can interpret them correctly. This ensures that students who prefer using their laptop with a screen reader can read the material without obstacles. According to the National Centre on Accessible Educational Materials, examples of accessible formats include “audio, braille, large print, tactile graphics, and digital text conforming with accessibility standards” (CAST, n.d.) Our project covers all of these. Screen-reader-friendly e-text is perhaps the most versatile format, as it can be rendered in audio, Braille or enlarged visually depending on the user’s device. We expect that the accessible digital files we create will also be shareable resources; for example, if one university converts a popular textbook into an accessible e-book, it can be distributed to others, maximising impact. Part of our process is documenting conversion workflows so university libraries can continue producing such formats beyond the project.

Workflow and Collaboration

The conversion process generally follows these steps: obtaining permission and source files from publishers (when needed) – we leverage educational exemptions and fair use provisions where possible; running OCR on print-only materials to get a base text (proofread for accuracy); formatting the text for each output (Braille translation, adding image descriptions, etc.); quality checking each format with actual users (e.g. having a blind student test-read a Braille sample or having a low-vision student review a large-print layout); and finally, dissemination of the accessible copies through a library system or the EVISVision app. We have engaged with the Accessible Book Consortium and local blindness organisations to ensure adherence to best practices and to possibly contribute our outputs to broader initiatives like Bookshare or the Marrakesh Treaty libraries. By the end of the project, the aim is not only to have created a repository of accessible academic materials in pilot subjects, but also to have established a replicable model (guidelines, training for transcribers, and possibly procurement of equipment like Braille embossers) so that each institution can continue converting new materials each semester.

Conclusion

Promoting inclusive higher education for students with visual impairments requires more than policy declarations; it demands deliberate investment in accessible technologies, inclusive pedagogical practices, institutional commitment, and sustained stakeholder collaboration. This paper presented a comprehensive framework for addressing barriers faced by visually impaired students within Nigerian universities through the integration of assistive technology development, educator training, accessible learning materials, and policy advocacy.

The proposed EVISVision application demonstrates how locally relevant technological innovations can enhance independent learning and improve access to educational resources. Similarly, the conversion of academic materials into accessible formats and the strengthening of educator competencies can significantly improve participation and academic success among students with visual impairments.

For sustainable impact, universities should institutionalise disability support services, allocate adequate funding for assistive technologies, and incorporate inclusive education principles into strategic planning and staff development programmes. Policymakers should also strengthen the implementation of existing disability and inclusive education policies to ensure equitable access to quality higher education.

Ultimately, achieving an inclusive university system in Nigeria is both a social justice imperative and a developmental necessity. By removing barriers and expanding educational opportunities, Nigerian universities can create environments where students with visual impairments are empowered to realise their full academic and professional potential.

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