ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN EDUCATING STUDENTS WITH HEARING IMPAIRMENT: PERCEPTIONS AND CHALLENGES AT FEDERAL UNIVERSITY DUTSIN-MA, KATSINA STATE, NIGERIA

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Abstract
The study investigated the role of Artificial Intelligence (AI) in educating students with hearing impairment in Federal University Dutsin-Ma, Katsina State, Nigeria. The study was guided by three objectives and three corresponding research questions. The study adopted survey research design. The population of the study comprises all students with hearing impairment in the department of Special Education, Federal University Dutsin-Ma, Katsina State, from which 20 students with hearing impairment were purposively selected as sample for the study. Artificial Intelligence in Hearing-Impaired Education Questionnaire (AIHIEQ) was used as the instrument for data collection with reliability coefficient of 0.72. The research questions were answered using descriptive statistics of mean and standard deviation. The findings of the study revealed that students with hearing impairment perceive AI-based educational tools as positively contributing to classroom participation and academic performance in Federal University Dutsin-Ma, Katsina State. The study found significant gaps in the availability and utilization of AI-based assistive educational tools among students with hearing impairment in the institution, with respondents indicating limited access to speech-to-text software, sign-language recognition applications, and AI-powered visual aid. The study concluded that students with hearing impairment can learn better if there is utilization of AI-based assistive tools and it helps to improve learning outcomes of students with hearing impairment in Federal University Dutsin-Ma, Katsina State. Based on the findings, the study recommended among others that the University Management, Ministry of Education, both Federal and State, in collaboration with the National Universities Commission and the National Commission for Persons with Disabilities, should formulate and implement comprehensive policies that promote the adoption of AI-driven assistive technologies in inclusive education.
Key words: Artificial Intelligence, Hearing Impairment, Perception, Challenges.

Introduction
Access to quality education remains a pressing challenge for millions of students worldwide, especially for those who experience hearing impairment. Globally, approximately 360 million

people live with hearing loss, many of whom face significant barriers in educational settings due to limitations in communication, access to auditory instruction, and assistive technologies (Karpińska-Szaj, 2024). In inclusive classrooms, students who are deaf or had hearing impairment often struggle to participate fully in oral instruction, respond in real time, or access the same pace of learning as their hearing peers. Beyond students, teachers with hearing impairment similarly navigate constrained instructional environments, limited professional-development opportunities, and often face communication gaps in the classroom (O'Connell, 2024).

Inclusive education and assistive technology adoption present multiple systemic obstacles especially in the sub-Saharan Africa where we have infrastructural deficiencies, shortage of trained educators, resource limitations and societal stigma combine to hinder academic progress for students with disabilities (Eze & Anyanwu, 2025). While African educational systems are increasingly acknowledging the importance of accessibility and assistive technologies, the implementation of advanced solutions remains uneven. A number of African startups are now using artificial intelligence (AI) to create inclusive tools signaling progress, yet many schools still lack basic technology infrastructure, teacher training, and contextually-adapted resources (CediRates, 2025).

The scale of hearing impairment is substantial to about 8.5 million Nigerians that live with hearing impairment, reflecting the national dimension of the problem (Ademokoya, 2020). Despite this, Nigerian classrooms often lack sufficient assistive-technology supports to meet the needs of students with disabilities; for instance, many regular schools do not provide adaptive devices or trained personnel. Ekpete and Blessing (2025) highlight inadequate infrastructure, insufficient teacher training, and a shortage of appropriate teaching resources in classrooms serving students with sensory impairments. Moreover, the integration of artificial intelligence into national education policy remains limited. Obidiebube, Ikwelle, and Iwuagwu (2025) argue that AI adoption in Nigeria's education system is still at an early stage, constrained by factors such as low awareness, infrastructure deficits, and resource constraints. Schools struggle with access to even basic educational technologies, limiting the potential for more advanced AI-enabled supports. Teachers of hearing-impaired students may lack the necessary training or tools for using adaptive technologies, and students often remain excluded from real-time communication and interaction (Ogwo, 2024).

In Federal University Dutsin-Ma, the stakes are even more localized and acute. Public tertiary institutions in this region often contend with limited infrastructure, inconsistent electricity supply, a shortage of specialist teachers trained in sign language and assistive technology, and insufficient funding for inclusive education programmes. These constraints mean that even where AI-enabled assistive tools might be available in principle, their adoption, maintenance and integration into everyday teaching and learning are fraught with complexity (Anyanwu, 2025).

Recognizing the issues above, the present study examines the role of AI in educating students with hearing impairment and supporting hearing-impaired teachers in Federal University Dutsin-Ma, Katsina State, Nigeria. This research aims to generate grounded evidence on how

AI-based assistive educational tools can enhance classroom participation, communication, and academic outcomes. It will also inform special educators, counsellors, and policymakers on the need to institutionalize and strengthen the use of AI based assistive technology tools in the education of hearing impaired students. Ensuring that hearing impaired students that are properly trained will not only enhance academic outcomes but also set them on the path to long-term career and personal success.

Statement of the Problem

Despite the global push toward inclusive education, research in Nigerian tertiary education has documented that students with hearing impairment often lack access to sign language interpreters and real-time communication support in lectures (Onuigbo *et al*., 2018). While Artificial Intelligence (AI) technologies such as automatic speech recognition, real-time captioning, and sign language translation systems have demonstrated potential in addressing these challenges internationally, their adoption, availability, and effectiveness in Nigerian universities remain largely unexplored.

At Federal University Dutsin-Ma, students with hearing impairment are likely to experience difficulties in accessing spoken lecture content and participating fully in classroom activities due to limited communication support and this is a challenge that aligns with findings by Jaiyeola and Adeyemo (2018), which reported that deaf and hard-of-hearing students in Nigerian educational settings often struggle with communication barriers that affect their academic and social engagement. Furthermore, the extent to which AI-based assistive technologies are available, utilized, or perceived as beneficial by these students has not been systematically investigated. Compounding these issues are reported infrastructural limitations, including unreliable internet connectivity, inconsistent power supply, and insufficient institutional investment in assistive technologies.

This study therefore seeks to examine the perceptions of students with hearing impairment regarding AI-based educational tools, the current state of AI tool availability and usage, and identify the barriers that hinder effective adoption of these technologies at Federal University Dutsin-Ma, Katsina State. These will help in gaining insight that is essential for shaping institutional policies, directing resource allocation, and boosting academic outcomes for hearing-impaired students in Nigerian higher education.

Objectives of the Study

The study seeks to;

1. The role of AI on educating students with hearing impairment in Federal University Dutsin-Ma.
2. The perception of students with hearing impairment on AI tools in Federal University Dutsin-Ma.
3. The challenges faced by students with hearing impairment in the adoption and use of AI tools in Federal University Dutsin-Ma.

Research Questions

1. What are the roles of AI on educating students with hearing impairment in Federal University Dutsin-Ma?

2. What are the perceptions of students with hearing impairment regarding the availability and use of AI-based assistive educational tools in Federal University Dutsin-Ma?
3. What are the challenges influencing the adoption and effective use of AI-based educational tools in inclusive classrooms for hearing impairment in Federal University Dutsin-Ma?

Methodology

This study used a survey research design to examine the perceptions and experiences of students with hearing impairment regarding AI tools in their education. The study focused on the Department of Special Education at Federal University Dutsin-Ma, Katsina State, where all 26 students with hearing impairment formed the population. Purposive sampling technique was used to select 20 students who participated in the study. Data were collected using a questionnaire called the Artificial Intelligence in Hearing-Impaired Education Questionnaire (AIHIEQ). Two experts from both the University's Test, Measurement and Evaluation Unit and Special Education Department reviewed the questionnaire to ensure it was appropriate and accurate. The questionnaire's reliability was tested using the test-retest method, and Pearson Product Moment Correlation was applied, giving a reliability score of 0.72. The data were analyzed using mean and standard deviation, with 2.50 set as the cutoff point scores above this indicate agreement, while scores below indicate disagreement, following standard practice in educational research (Boone & Boone, 2012; Agwu & Kalu, 2015).

Results

Research Question One: What are the roles of AI on educating students with hearing impairment in Federal University Dutsin-Ma?

Table 1: Mean and standard deviation of the roles of AI on educating students with hearing impairment

S/N	Item Statements	N	Mean	Standard Deviation
1.	AI tools help me better understand lectures and classroom discussions.	20	3.40	.54
2.	The use of AI technologies increases my participation during lessons.	20	3.10	.24
3.	I perform better academically when I use AI-based assistive learning tools.	20	2.30	.56
4.	AI tools reduce communication barriers between me and my lecturers.	20	2.45	.41
5.	AI has made my learning experience more inclusive and enjoyable.	20	3.05	.20
	Decision Mean		**2.86**	**0.46**

Table 1 shows that items 1, 2 and 5 have means above the decision benchmark of 2.50, this implies that many respondents feel that AI tools and related tools help them follow lectures, increase participation, and motivate engagement. However, responses in items 3 and 4 fall

below the benchmark which indicated that respondents were less convinced that AI consistently improves exam scores or can replace human interpreters. With a decision mean of 2.86, students with hearing impairment express moderately positive perceptions of AI tools. However, it is important to note that Item 3, which directly measures perceived academic performance improvement (mean = 2.30), fell below t. They value how it makes learning materials easier to access and supports their studies.

Research Question Two: What are the perceptions of students with hearing impairment regarding the availability and use of AI-based assistive educational tools in Federal University Dutsin-Ma?

Table 2: Mean and Standard Deviation on the perception of students with hearing impairment in Federal University Dutsin-ma.

S/N	Item Statements	N	Mean	Standard Deviation
6.	AI-based captioning or speech-to-text software is available in my department.	20	2.15	.59
7.	Hearing-impaired lecturers and students use AI tools during teaching and learning.	20	2.10	.95
8.	AI-powered sign-language recognition applications are used in my classes.	20	2.45	.78
9.	I have access to AI-based visual aids such as smart displays or captioned videos.	20	2.35	.87
10.	The university provides institutional support for training and using AI tools.	20	3.05	.59
	Decision Mean		**2.42**	**0.38**

Table 2 shows that item 6, 7, 8, and 9 had mean scores below the mean benchmark of 2.50, it implies that respondents were of the opinions that AI-based captioning or speech-to-text software is not available in their department., that hearing-impaired lecturers and students do not use AI tools during teaching and learning, that AI-powered sign-language recognition applications are not used in their various classes and that they have no access to AI-based visual aids such as smart displays or captioned videos. Item number 10 had mean scores above the mean benchmark of 2.50, it implies that respondents were of the opinions that the university provides institutional support for training and using AI tools. therefore, from the responses of the respondents one can find that AI-based assistive educational tools are currently not available and used for students with hearing impairment and hearing-impaired lecturers as indicated by the decision mean score of 2.42.

Research Question Three: What are the challenges influencing the adoption and effective use of AI-based educational tools in inclusive classrooms for hearing impairment in Federal University Dutsin-Ma?

Table 3: Mean and Standard Deviation on Challenges to AI adoption in inclusive classrooms for the hearing impaired Students.

S/N	Item Statements	N	Mean	Standard Deviation
11.	Lack of awareness about AI tools limits their use among hearing-impaired students.	20	3.60	.50
12.	Poor internet connectivity and power supply make AI use difficult.	20	3.35	.72
13.	Some AI applications are not compatible with local devices or classroom settings.	20	2.35	.66
14.	There is insufficient funding or institutional investment in AI technology.	20	3.45	.59
15.	Students and lecturers lack adequate training on how to use AI tools effectively.	20	3.55	.88
	Decision Mean		**3.26**	**0.52**

Table 3 shows that item 11, 12, 14 and 15 had mean scores above the mean benchmark of 2.50, this implies that respondents were of the opinions that lack of awareness about AI tools limits their use among hearing-impaired students, that poor internet connectivity and power supply make AI use difficult, that there is insufficient funding or institutional investment in AI technology, and that students and lecturers lack adequate training on how to use AI tools effectively. Item 13 had mean score below the mean benchmark of 2.50, this implies that respondents were of the opinions some AI applications are not compatible with local devices or classroom settings. It can therefore be deduced from the responses of the respondents that there are challenges influencing the adoption and effective use of AI-based educational tools in inclusive classrooms for hearing impairment students in Federal University Dutsin-Ma, Katsina State as indicated by the decision mean score of 3.26.

Discussion of Findings

The finding for research question one revealed that students with hearing impairment perceive AI-based educational tools as contributing positively to classroom participation and academic performance. Many respondents agreed that tools such as speech-to-text captioning, automated transcription and visual aids help them engage more actively. However, a subset of students expressed reservations about the reliability of these tools for high-stakes assessments or as full replacements for human interpreters. This is in line with the research of Alit and Ahmad (2025) showing that while assistive technologies deliver accessibility gains, their impact on academic achievement remains under-explored and dependent on context.

The finding for research question two showed that various AI-based assistive educational tools are currently not available and used by students and hearing-impaired lecturers, this finding corresponds with the study by Ashfaq *et al.,* (2024) that carried out their study on the impact of artificial intelligence on quality of life for deaf and hard of hearing students. The study found that AI-enabled captioning and tutoring systems are promising, yet access and infrastructure remain key constraints. He further noted that availability of tools alone is insufficient without training, maintenance and institutional commitment.

The finding for research question three revealed that major challenges such as limited infrastructure (internet, electricity), cost of technology, insufficient training of special educators and institutional support significantly influence the adoption and effective use of AI-based educational tools in the classrooms. Many students and lecturers identified these barriers as more pressing than the tools themselves. This is in agreement with Omodara and Adesina (2022), who identified infrastructure and training as dominant constraints across similar contexts.

Conclusion

Based on the findings of this study, it is concluded that the integration of Artificial Intelligence (AI) in the education of students with hearing impairment has a positive and transformative influence on teaching and learning outcomes at Federal University Dutsin-Ma. The study established that AI-powered tools such as speech-to-text applications, visual learning platforms, and sign language recognition systems significantly enhance classroom participation, communication, and academic performance among students with hearing impairment. However, it is to be noted that limited accessibility, insufficient technical support, and inadequate training on AI tools still pose barriers to full adoption and effectiveness.

Also, the study concluded that the utilization of AI-based assistive tools improved learning outcomes of students with hearing impairment. That is, AI does not only bridges communication gaps between hearing-impaired students and lecturers but also promotes inclusivity and equal learning opportunities in higher education.

Recommendations

Based on the findings, discussions and conclusion of this study, the following recommendations were made:

1. The Federal and State Ministries of Education, together with NUC and NCPWD, should create and enforce clear policies that support the use of AI-driven assistive technologies in inclusive education.
2. Special educators should be equipped to use tools like real-time captioning, sign-language translation software, and visual learning platforms.
3. Developers of AI-based educational technologies should work closely with special educators, audiologists, and disability advocates to create user-friendly tools tailored to the needs of hearing-impaired students in Africa.

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