# Perception of Students with Hearing Impairment and Educators Regarding the Use of Artificial Intelligence (AI) Applications for Sign Language Interpretation in Nigeria

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## Abstract

This study explored the perception of students with hearing impairment and educators regarding the use of Artificial Intelligence (AI) applications for sign language interpretation in Nigeria. The study made use of three specific purpose and three research questions. Anchored on the Technology Acceptance Model (TAM), developed by Fred D. Davis in 1986 and formally introduced in 1989, the study adopted a mixed-methods approach. A total of 40 participants-comprising 30 students with hearing impairment and 10 educators were purposively selected from special schools across Nigeria. Data were collected through structured questionnaires, semi-structured interviews, and focus group discussions. Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed thematically. The findings indicated a moderate to high level of awareness and a generally positive acceptance of AI sign language interpretation apps among both students and educators. Participants reported benefits such as improved communication, increased autonomy in learning, and better classroom engagement. However, they also identified challenges including limited linguistic accuracy of AI systems with Nigerian Sign Language, poor internet access, and affordability issues. The study concluded that while AI-powered sign language interpretation has the potential to enhance inclusive education, its success is influenced by user perceptions of usefulness and ease of use, as explained by TAM. The study recommends policy support, inclusive design, and localized technological adaptation to maximize the benefits of AI in special education.

## Keywords

Technology Acceptance Model, Hearing impairment, Sign language, Artificial Intelligence, Inclusive education, Perception, Nigeria

## 1. Introduction

### 1.1 Background

In an increasingly digital world, technology continues to reshape how we communicate, learn, and connect-especially for individuals with disabilities. For students with hearing impairment, communication barriers often hinder full participation in educational settings, particularly in contexts like Nigeria, where access to trained human interpreters is limited. The rise of Artificial Intelligence (AI) has introduced new possibilities through mobile applications that offer real-time translation, captioning, and visual language processing. These tools have the potential to foster inclusivity and enhance learning experiences for individuals who are hearing impaired. However, their effectiveness depends largely on the perceptions and acceptance of both students and educators. This study seeks to explore these perceptions with a focus on the emerging role of AI Apps in Sign Language Interpretation.

### 1.2 Statement of the Problem

In the evolving educational landscape, fostering inclusivity remains essential, particularly for students with hearing impairment. Traditional methods such as relying on human sign language interpreters, while valuable, face limitations including high costs, interpreter shortages, and inconsistent availability-especially within under-resourced Nigerian schools. With the rise of Artificial Intelligence (AI), new opportunities have emerged through AI-powered sign language interpretation apps. These tools offer the potential for real-time communication support, improved classroom participation, and greater independence for students. However, despite the growing global interest and use of such technologies, their awareness, acceptance, and perceived impact within Nigerian educational settings remain largely unexplored.

Existing studies highlight that AI sign language tools can enhance teaching and learning by translating sign language to text or speech and vice versa, thereby bridging communication barriers. Educators have reported improved instructional delivery and interaction with students using these tools, while students themselves express increased comprehension

and autonomy. Nevertheless, challenges persist, including limited digital infrastructure, lack of local sign language datasets, ethical considerations, and insufficient training on how to use the tools effectively.

In Nigeria, there is a significant gap in empirical evidence regarding how students with hearing impairment and educators perceive these AI applications. Little is known about their level of awareness, the extent to which they find these technologies useful and easy to use, or the benefits and challenges they associate with their implementation. This study aims to address these gaps by exploring the perceptions of both groups, examining their views on the relevance, practicality, and potential impact of AI apps for sign language interpretation on the educational experience of students with hearing impairment. Through this, the research intends to provide insights that can inform inclusive education practices, influence policy direction, and guide the development of user-centered AI tools tailored to the Nigerian context.

## 1.3 Purpose of the Study

The main purpose of the study is to explore the perception of students with hearing impairment and educators on the AI Apps for Sign language interpretation in Nigeria. Specifically, the study aims to:

examine the level of awareness and acceptance of AI apps for sign language interpretation among students with hearing impairment and educators.

identify the perceived benefits and challenges associated with the use of AI apps for sign language interpretation in educational settings.

explore how students with hearing impairment and educators perceive the potential impact of AI apps for sign language interpretation on the educational experiences of students with hearing impairment.

## 1.4 Research Questions

What is the level of awareness and acceptance of AI apps for sign language interpretation among students with hearing impairment and educators?

What are the perceived benefits and challenges of using AI apps for sign language interpretation in educational settings?

## 2. Literature Review

Sign Language Interpretation involves converting spoken language into sign language, or vice versa, either in real-time or through pre-recorded means, to facilitate communication between hearing individuals and those who are Deaf or hard of hearing. It plays a vital role in ensuring access to education, healthcare, legal services, and full participation in society. Technological advancements-particularly in computer vision, deep learning, and natural language processing-have enabled the development of intelligent sign language systems [1,2,3,4]. While much progress has been recorded globally, Nigeria still faces challenges such as limited access to trained interpreters, poor digital infrastructure, and a lack of localized AI datasets for Nigerian Sign Language. Nonetheless, ongoing efforts by NGOs and emerging tech innovations indicate a growing potential for inclusive communication through AI Apps for Sign Language Interpretation.

The integration of AI-driven sign language interpretation applications into educational environments is revolutionizing how students with hearing impairments access learning and communication. These innovations address persistent challenges such as the shortage of trained sign language interpreters, communication barriers in inclusive classrooms, and the broader issue of educational exclusion for deaf learners, particularly in resource-limited settings like Nigeria. AI-powered tools utilize advanced technologies such as deep learning, computer vision, and natural language processing to recognize and translate sign gestures into spoken or written language in real time, thereby supporting both instruction and learner engagement [1,2,4].

Typically, these applications work by capturing hand gestures via cameras, processing the input through models such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), or transformers, and delivering real-time translation from sign to text or voice. Their use spans classroom instruction, e-learning, assessment settings, and social communication, functioning both as assistive tools for students and teaching aids for educators who lack sign language proficiency [5].

Empirical studies from 2016 to 2025 demonstrate the potential of these tools. For instance, Dewangan et al. developed a web application for converting Indian Sign Language (ISL) gestures into text and voice using CNNs and Media Pipe, optimized for educational use [4]. Sucharitha et al. utilized VGG16 and transfer learning to enhance recognition accuracy while emphasizing privacy benefits over manual interpretation [1]. Similarly, Palanisamy et al. created SIGNEASE, which integrates deep learning and graph theory for educational and social enhancement, while Morillas-Espejo and Martínez-Martín demonstrated approximately 80% accuracy in real-time Spanish Sign Language translation using CNNs and vision transformers in classroom settings [2,5].

Although Nigeria lacks a significant body of indexed empirical literature on AI sign language apps in education, developmental initiatives such as "SignApp" by the Inclusive Nigeria Project and DeafTech Nigeria's advocacy for government-led AI interpreter integration suggest increasing exploration and interest. However, challenges persist,

including the absence of localized datasets for Nigerian Sign Language, limited infrastructure, insufficient government policy support, and educator resistance or unfamiliarity with such technologies.

Despite these constraints, the international evidence underscores the transformative potential of AI sign language apps in promoting educational inclusion, autonomy, and communication for deaf students. As these tools continue to evolve, it becomes increasingly important to understand the perception of students with hearing impairment and educators on the use of AI Apps for Sign Language Interpretation.

The use of AI-based sign language interpretation applications is gaining traction as a promising solution to bridge communication gaps for students with hearing impairment in Nigerian classrooms. While direct empirical studies on this topic in Nigeria remain limited, exploring how students and educators perceive these tools-especially regarding their awareness, perceived advantages, implementation challenges, and impact on teaching and learning-is essential for successful adoption and scaling. Existing international literature and broader disability-tech research provide valuable insights that help contextualize the current Nigerian landscape [4,6,7,8,9].

In terms of awareness and acceptance within Nigeria, empirical data is still emerging. However, anecdotal reports and NGO-led pilot projects suggest that general awareness remains low, particularly in under-resourced public schools with limited access to digital technologies. Initiatives like DeafTech Nigeria have reported that once exposed to AI sign apps, many students respond with interest and optimism, indicating a high potential for acceptance if proper awareness strategies are implemented. Nkomoki et al. further support this by showing that increased usage of AI translation tools correlates positively with user satisfaction, implying similar prospects for AI sign language apps in the Nigerian educational context [9].

Several studies have outlined clear benefits perceived by both students and educators when using AI-based sign language apps. Kamber notes that such tools can foster academic independence and motivation among students with disabilities [6]. Dewangan et al. emphasize how real-time gesture-to-speech applications promote more active classroom participation [4]. From the educators' perspective, Ghimire and Neupane highlight how these tools support more inclusive and personalized instructional delivery [7]. Additionally, Ponomarenko et al. suggest that AI tools can help students with hearing impairments better grasp digital communication norms and etiquette, further enhancing their digital literacy [8].

Despite these benefits, several challenges have also been reported. A significant limitation is the lack of robust models trained on Nigerian Sign Language (NSL), as most existing applications are optimized for American or Indian Sign Language. Teachers and school staff often lack the technical training necessary to implement and maintain these tools effectively. Infrastructure-related issues-such as unreliable electricity, outdated hardware, and poor internet connectivity-further hinder deployment. Moreover, data privacy and ethical concerns, especially with cloud-based or camera-enabled applications, have been raised. Kamber argues for the need to establish national policy frameworks to ensure equitable access and safeguard student data in the use of AI tools [6].

Regarding their educational impact, both students and teachers perceive these technologies as valuable assets. They are believed to support greater self-expression, enhance peer communication, and reduce dependence on human interpreters. These apps are also thought to promote confidence and encourage digital literacy among deaf students, aiding their integration into mainstream classrooms. For instance, the findings of Ponomarenko et al. revealed that students with hearing impairments often struggle with understanding digital communication conventions, suggesting that AI tools embedded with instructional guidance can serve a dual role in enhancing communication and cultivating proper online behavior [8].

In summary, while awareness of AI-powered sign language interpretation tools among Nigerian students and educators is still developing, the level of acceptance increases significantly with exposure and hands-on experience. The perceived benefits-ranging from enhanced communication and autonomy to improved inclusivity-are strong motivators for broader adoption. Nonetheless, challenges related to infrastructure, local language integration, teacher training, and privacy must be addressed. Global evidence underscores the transformative potential of these technologies, but localized efforts are necessary to validate their effectiveness and fully understand the perception of students with hearing impairment and educators on the use of AI Apps for Sign Language Interpretation.

A highly appropriate theory for examining the perception of students with hearing impairment and educators regarding the use of AI apps for sign language interpretation in Nigeria is the Technology Acceptance Model (TAM). This model was developed by Fred D. Davis in 1986 and formally introduced in 1989 through his seminal paper titled *"Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology"* [10].

The original proposition of the theory states that *"the actual use of a technology system is influenced directly by behavioral intention to use, which in turn is influenced by the user's attitude toward using the system, and indirectly by perceived usefulness and perceived ease of use"* [10]. In essence, the theory emphasizes that two key beliefs-perceived usefulness and perceived ease of use-play a central role in shaping a user's attitude toward a technology. Perceived usefulness refers to the extent to which a person believes that using a particular system will improve their performance, while perceived ease of use relates to how effortless they believe the system will be to operate. These beliefs form the

foundation for users' attitudes, which influence their intention to use the technology and, ultimately, their actual usage behavior.

The Technology Acceptance Model is particularly relevant to this study because it provides a clear framework for understanding how students with hearing impairment and their educators evaluate AI-based sign language interpretation apps. For students, the model helps to assess whether they believe these applications make learning more accessible and whether they are easy to use without added stress or difficulty. For educators, TAM offers insights into whether they find the technology useful for delivering inclusive instruction and facilitating communication in classrooms that serve both hearing and non-hearing learners.

Furthermore, the model helps to explain adoption challenges such as lack of digital literacy, inadequate infrastructure, and technical skill gaps that may negatively affect users' perceptions. By understanding these barriers through the lens of TAM, the study can also explore how to design better training, support systems, and policy interventions to encourage broader acceptance of these tools in Nigerian educational settings.

In conclusion, TAM serves as a robust theoretical lens for analysing the beliefs, attitudes, and behavioral intentions of both students and educators in relation to AI technology. Its application provides a structured approach to understanding the perception of students with hearing impairment and educators on the use of AI apps for sign language interpretation in Nigeria.

How do students with hearing impairment and educators perceive the potential impact of AI apps for sign language interpretation on the educational experiences of students with hearing impairment?

## 3. Research Methodology

This study adopted a mixed method research design to investigate the level of awareness, perceived benefits, challenges, and educational impact of AI applications for sign language interpretation among students with hearing impairment and their educators. The design was considered suitable as it allowed the researcher to systematically collect, analyze, and interpret data regarding participants' perceptions without manipulating any variables.

The population of the study comprised students with hearing impairment and educators working in both special and inclusive schools across selected institutions in Nigeria. A purposive sampling technique was employed to select participants who had prior experience with or exposure to sign language interpretation tools, including AI-based applications. The sample consisted of 30 students with hearing impairment and 10 educators, making a total of 40 participants.

Data were collected through a semi-structured questionnaire and in-depth interviews. The questionnaire consisted of both closed and open-ended items, designed to capture participants' awareness, acceptance, perceived benefits, challenges, and views on the impact of AI sign language interpretation tools. The instrument was validated by experts in special education and educational technology to ensure content relevance and clarity.

A pilot study was conducted with five participants to test the reliability of the questionnaire, and a Cronbach's alpha coefficient of 0.78 was obtained, indicating a good level of internal consistency. Ethical clearance was obtained, and participants were assured of confidentiality and voluntary participation.

Quantitative data collected from the questionnaires were analyzed using descriptive statistics such as frequency counts and percentages, while qualitative responses from interviews were analyzed thematically to extract major patterns and insights. This mixed-method approach enabled a more comprehensive understanding of participants' perceptions regarding the use of AI applications for sign language interpretation in educational settings.

## 4. Results of Findings

### 4.1 Demographic Information of Respondents

**Table 1.** Gender Distribution of Respondents

| Gender | Students (n=30) | Educators (n=10) | Total (n=40) |
|--------|-----------------|------------------|--------------|
| **Male** | 16 | 4 | 20 |
| **Female** | 14 | 6 | 20 |

**Interpretation & Implication**

Based on Table 1, there was a balanced gender distribution among participants. This allows for generalization across gender lines and suggests inclusive representation in understanding perceptions of AI applications in sign language interpretation.

**Table 2.** Age Distribution of Respondents

| Age Range | Students (n=30) | Educators (n=10) | Total (n=40) |
|---|---|---|---|
| **10-14 years** | 10 | 0 | 10 |
| **15-19 years** | 20 | 0 | 20 |
| **30-39 years** | 0 | 6 | 6 |
| **40+ years** | 0 | 4 | 4 |

**Interpretation & Implication:**

As shown in Table 2, students with hearing impairment were mostly in their teenage years, while educators were adults. The age gap implies differing levels of exposure to and expectations from technology, which may influence their perceptions of AI tools differently.

Quantitative Data Results

**Table 3.** Awareness and Acceptance of AI Apps for Sign Language Interpretation

| Item | Mean Score | Decision |
|---|---|---|
| **I am aware of AI apps for sign language interpretation** | 3.90 | High |
| **I have used or seen someone use AI sign language tools** | 3.20 | Moderate |
| **I am willing to use AI apps regularly if available** | 4.10 | Very High |
| **I find the idea of AI interpreting sign language easy to understand** | 3.85 | High |

**Interpretation & Implication**

According to Table 3, the high awareness level among participants suggests growing familiarity with AI-based solutions. Willingness to use AI apps was very high, indicating acceptance. However, moderate usage levels suggest a lack of access or exposure, indicating the need for broader implementation and awareness programs.

**Table 4.** Perceived Benefits of AI Apps

| Item | Mean Score | Decision |
|---|---|---|
| **AI apps can make learning easier for students with hearing loss** | 4.35 | Very High |
| **AI apps help bridge communication with hearing teachers/students** | 4.10 | Very High |
| **AI tools reduce dependence on human interpreters** | 3.95 | High |
| **AI makes access to inclusive education more realistic** | 4.25 | Very High |

**Interpretation & Implication**

Table 4 summarized the participants perceived AI apps as highly beneficial, especially in enhancing learning, communication, and independence. This supports arguments for integrating AI tools into inclusive educational systems in Nigeria.

**Table 5.** Perceived Challenges of AI Apps

| Item | Mean Score | Decision |
|---|---|---|
| **Lack of stable electricity/internet limits AI app use** | 4.40 | Very High |
| **AI apps may not understand all sign language expressions** | 4.00 | High |
| **Some educators may not be digitally literate** | 3.85 | High |
| **Cost of AI-enabled devices is too high for many schools/students** | 4.15 | Very High |

**Interpretation & Implication**

The key challenges include infrastructure deficits, limited AI training data for local sign languages, and affordability issues are presented in Table 5. These barriers underscore the importance of localized AI development, teacher training, and policy support in Nigeria.

**4.2 Qualitative Data Results (Thematic Analysis)**

Theme 1: Accessibility and Educational Equity

*"If AI apps are introduced in our classrooms, it will help us understand teachers better, especially when there's no interpreter."* - Student participant

**Interpretation & Implication**

Students believe AI apps could reduce communication barriers. It highlights the potential of AI to promote educational equity for students with hearing impairment, particularly in under-resourced Nigerian schools.

Theme 2: Limited Exposure and Technological Infrastructure

*"Most schools don't have the internet or devices that can support these apps. Even teachers don't know how to use them."* - Educator participant

**Interpretation & Implication**

Despite interest, limited infrastructure and digital literacy constrain AI adoption. This reflects a systemic gap that policymakers and education planners must address to create a supportive ecosystem.

Theme 3: AI as Complementary, Not Replacement

*"AI can help, but I still prefer human interpreters for emotional expression and better understanding."* - Student participant

**Interpretation & Implication**

Participants emphasized that while AI apps are useful, they may not fully replicate the nuance and emotion conveyed by human interpreters. AI should therefore be positioned as a complementary tool in inclusive education settings.

Theme 4: Hope for Inclusive Future

*"If these tools are supported by government and made free, it can change lives of many deaf children."* - Educator participant

**Interpretation & Implication**

There is optimism about AI transforming education if adequately supported. This suggests strong grassroots willingness to adopt AI, provided the government, NGOs, and private sector invest in accessibility solutions.

The qualitative findings indicate a significant demand from educators and students for enhanced government and NGO involvement in expanding access to AI technologies. This aligns with calls in the literature for public-private and NGO partnerships to support the scaling of AI-driven inclusive education in Nigeria. [11,12,13] The integration of AI can transform educational experiences - particularly for learners with disabilities - by personalizing learning and improving accessibility [14].

Importance of Public-Private Partnerships

Resource Allocation: Effective partnerships can ensure adequate funding and resources for technology implementation [15].

Policy Formulation: Collaborative efforts can lead to the development of inclusive policies that address the digital divide [16].

Training Programs: Joint initiatives can facilitate continuous professional development for educators, enhancing their ability to utilize AI effectively [17].

Challenges to Implementation

Digital Divide: Significant barriers remain, including unequal access to technology and insufficient infrastructure [18].

Ethical Concerns: Issues such as data privacy and algorithmic bias must be addressed to ensure equitable outcomes [19].

While the push for AI integration in education is promising, it is essential to recognize the ongoing challenges that may hinder its effectiveness, necessitating a balanced approach to implementation.

**5. Discussion of Findings**

The findings of this study reveal several important insights into the awareness, acceptance, benefits, and challenges associated with AI applications for sign language interpretation among students with hearing impairment and their educators in Nigeria.

One major result was that both students and educators demonstrated a high level of awareness and a positive perception of AI apps for sign language interpretation. This aligns with research showing significant digital literacy among

teachers in Nigeria: [20] found that many Nigerian teachers are aware of and value digital tools in teaching. Similarly, findings by [21] indicate that students in Nigerian secondary schools express confidence in using digital tools, even though they face infrastructure constraints.

The willingness of students to use such technologies reflects a growing readiness to embrace innovation in learning. While not specific to hearing-impaired students, a study in public secondary schools found that digital learning tools significantly enhance student engagement and retention, suggesting broad user receptivity. The study also found that AI apps are perceived to enhance communication, improve learning outcomes, and reduce dependency on human interpreters. These benefits echo broader literature on AI in Nigerian schools, which highlights pedagogic, administrative, and socio-economic advantages. Furthermore, a case study of a Sign-to-Speech model for Nigerian Sign Language (NSL) provides proof of concept that real-time interpretation is feasible, thereby potentially reducing reliance on interpreters.

However, despite these promising perceptions, the study identified key barriers: inadequate infrastructure (electricity, internet), the cost of devices, and limited teacher preparedness. These echo the practical challenges documented in broader AI adoption studies in Nigeria, where persistent power outages and poor internet coverage are seen as major constraints. On the educator-training front, [22] note that many teachers face low digital literacy, resistance to change, and limited institutional support.

Participants also expressed concern about the limitations of AI in fully capturing the complexity of sign language - specifically, facial expressions, cultural nuances, and context. While there is relatively limited literature on NSL-specific AI, more general work on sign language recognition points to substantial challenges: for example, sign language datasets are often limited, and models trained on foreign data may not generalize well to local sign languages. Moreover, the pioneering NSL dataset used in some AI models was created in collaboration with Nigerian stakeholders, but even then, interpretation fidelity (especially of non-manual features) remains a concern.

Finally, the qualitative findings suggest a strong desire among students and educators for more government and NGO involvement in scaling access to AI-based sign language tools. This resonates with calls in the literature: [23] argues that policies promoting public-private partnerships are critical to addressing infrastructural and capacity-building gaps. Also, in discussions of special education, inclusive education scholars emphasize the need for systemic support ; not just technological solutions for sustainable integration.

In summary, this study confirms that AI apps have significant potential to support inclusive education for students with hearing impairment in Nigeria. However, successful implementation hinges on addressing socio-technical challenges: infrastructure, localization (especially of sign language data), and educator capacity. This supports a socio-technical perspective: technology uptake depends not only on the tool, but on the broader social, institutional, and policy ecosystem into which it is embedded.

## 6. Summary, Conclusion and Recommendations

### 6.1 Summary of the Study

This study investigated the perceptions of students with hearing impairment and educators on the use of Artificial Intelligence (AI) applications for sign language interpretation in Nigeria. The study was guided by objectives that sought to explore the level of awareness, acceptance, perceived benefits, and challenges associated with AI apps among students and educators in special schools.

A mixed-methods research design was employed, combining both quantitative (questionnaire) and qualitative (interviews and focus group discussions) approaches. The sample comprised 40 participants, including 30 students with hearing impairment and 10 educators from selected special education schools in Nigeria. The study adopted the Technology Acceptance Model (TAM). as a theoretical framework. This model was developed by Fred D. Davis in 1986. Quantitative data were analyzed using frequency counts and percentages, while qualitative data were analyzed thematically. Key findings revealed a high level of awareness of AI apps for sign language interpretation among students and educators. Participants showed positive attitudes toward the use of these apps, recognizing their benefits in improving communication, fostering independence, and enhancing academic performance. However, challenges such as poor infrastructure, high cost of devices, and limitations in language recognition were also identified.

### 6.2 Conclusion

Based on the findings, it is evident that AI applications for sign language interpretation offer promising tools for promoting inclusive education among students with hearing impairment in Nigeria. Students and educators are aware of these technologies and are generally receptive to their use. The tools have the potential to enhance communication, promote learner autonomy, and support better academic outcomes.

Nonetheless, challenges such as limited access to reliable internet, inadequate digital infrastructure, high costs of technology, and lack of culturally appropriate AI models must be addressed. Moreover, there is a pressing need to localize AI apps to accommodate the unique structure of Nigerian Sign Language (NSL). The effective integration of AI in special education is not just a matter of technology adoption but one that requires policy support, teacher training, infrastructure development, and stakeholder engagement.

In conclusion, while AI apps hold the potential to transform education for the hearing impaired in Nigeria, their impact will depend largely on how well the social, institutional, and technological systems are aligned to support their use.

## 6.3 Recommendations

Based on the findings, the following recommendations are offered:
Government agencies such as the Federal Ministry of Education and the National Commission for Persons with Disabilities should develop and implement inclusive education policies that promote the use of AI-based tools for learners with hearing impairment.

There should be increased investment in ICT infrastructure in special education schools, including ensuring access to steady electricity, internet services, and modern digital devices.

Teachers and students should be provided with regular training and workshops on the use of AI applications for sign language interpretation to improve their digital competence and confidence in using such tools effectively.

Developers and stakeholders should collaborate to create AI models trained in Nigerian Sign Language (NSL), including its regional dialects and non-manual features such as facial expressions, to improve accuracy and user experience.

The government should partner with technology companies, NGOs, and international agencies to subsidize the cost of AI apps and devices and ensure wider access to underprivileged students with hearing impairments.

There should be continuous evaluation and feedback mechanisms integrated into the implementation of AI in education to measure its effectiveness, address challenges, and make improvements.

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