Inclusive Access and Utilization of AI-Powered Learning Platforms among Undergraduate Students in Kaduna State: Implications for Equitable Educational Policy

Uthman Shehu Lawal (PhD)
Department of Social Science Education
Kaduna State University, Kaduna-Nigeria

Dr. Muhammad Sani Mukhtar (Goni)
Department of Arts and Social Science Education
Kaduna State University, Kaduna
&
Bashir Mamman (PhD)
Department of Education Foundations
Kaduna State University, Kaduna

TETFund Sponsored

Abstract

This study examined awareness, equitable access, accessibility effectiveness, and predictors of inclusive utilization of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State, Nigeria, and drew implications for equitable higher education policy. Anchored on Rogers' Diffusion of Innovations Theory and Engeström's Activity Theory, the study adopted a convergent mixed-methods design involving a survey of 150 students with visual, hearing, physical, learning, and other disabilities across three public institutions, complemented by key informant interviews and focus group discussions. Quantitative data were collected using a validated Inclusive AI Access and Utilization Scale and analyzed with descriptive statistics, ANOVA, multiple regression, discriminant analysis, and partial least squares structural equation modeling, while qualitative data were thematically analyzed. Findings showed a significant but moderate level of awareness of AI learning tools (GM= 2.92), low equitable access (GM = 2.38), and moderately effective accessibility features (GM = 2.68), with STEM and professional disciplines reporting relatively higher utilization. Equitable access emerged as the strongest predictor of inclusive utilization, followed by perceived usefulness, awareness, institutional support, and accessibility effectiveness, with the regression model explaining (61.0%) of the variance and the PLS-SEM model indicating substantial predictive power for inclusive utilization (R^2 = 0.67). Qualitative themes highlighted that students typically discover AI through peers rather than formal orientation, face affordability and infrastructural constraints, experience uneven accessibility across tools, and are strongly affected by policy ambiguity, lecturer attitudes, and the strength of disability support structures. The study concludes that inclusive AI integration in Kaduna State universities depends less on the mere availability of AI platforms

and more on deliberate policies that enhance affordable access, enforce accessibility standards, legitimize assistive AI use, and meaningfully involve disabled students in AI-related decision-making. It was recommended among others that Universities in Kaduna State should institutionalize disability-inclusive AI literacy programmes for students and staff, covering ethical use, assistive applications, and accessible learning practices; Government should subsidize internet access, device acquisition, and selected AI subscriptions for students with disabilities to improve equitable access.

Keywords: Accessibility, Artificial, Education, Inclusive Intelligence, Policy

Introduction

Artificial intelligence is becoming increasingly influential in higher education across teaching, assessment, academic support, content generation, translation, note-taking, tutoring, and personalized learning. Universities now use or permit a wide range of AI-powered systems, including generative chat interfaces, adaptive learning platforms, automated captioning tools, predictive analytics systems, virtual assistants, intelligent tutoring systems, and accessibility-enhancing applications. This transition has expanded the possibilities for flexible learning, especially for students who require multimodal support, customized pacing, or alternative input and output options. At the same time, AI adoption is not inherently equitable. The benefits of these systems depend on whether students can afford devices and data, whether tools function with assistive technologies, whether learning materials are digitally accessible, and whether institutional rules allow disabled learners to use AI in ways that support rather than penalize them.

Inclusion has become a central concern because digital technologies can simultaneously reduce and reproduce educational inequalities. For students with disabilities, AI can improve participation through speech recognition, image description, smart note-taking, automated captioning, predictive text support, reading simplification, personalized scaffolding, and translation across modes of communication. Gibson (2024) observed that AI tools in higher education offer significant promise for more accessible and equitable learning, especially through captioning, image description, coding support, speech recognition, and multimodal assistance. Likewise, the Jisc National Centre for AI (2025) noted that generative AI is increasingly being treated as assistive technology itself and that students value AI systems for 24/7 support, reduced judgment, and improved accessibility. These developments suggest that AI can strengthen inclusion when implemented thoughtfully.

Artificial intelligence (AI) in education generally refers to computational systems that perform tasks requiring human-like intelligence, such as adaptive feedback, prediction, classification, and natural language interaction, within teaching, learning, and educational management processes (UNESCO, 2021; World Bank, 2024). AI-powered learning platforms are digital environments that embed such AI capabilities, for example, adaptive learning systems, intelligent tutoring systems, recommender systems for content, automated assessment tools, learning analytics dashboards, and generative AI assistants, to personalize

instruction, support assessment, and optimize learning pathways (Krishnan & Zaini, 2025; Larroucau et al., 2024). In higher education, AI-based learning tools (AI-LTs) include intelligent tutoring systems, automated writing evaluators, predictive analytics for at-risk students, AI-supported collaborative platforms, and chatbots integrated within learning management systems (LMS) (UNESCO, 2021).These platforms operate on large datasets generated from learners' interactions and thus raise issues of algorithmic bias, data privacy, and transparency, which are central to equitable access debates.

Inclusive access in the present topic goes beyond mere physical connectivity to encompass meaningful access, which includes availability of suitable devices, reliable internet, affordable data, accessible interfaces, and culturally and linguistically relevant content (Van Dijk, 2017; Mokoena & Seeletse, 2026; Mac Fadden *et al.*, 2024). In AI-mediated learning, inclusivity also implies that algorithms, interfaces, and learning resources do not systematically disadvantage any group of learners by gender, socio-economic status, disability, language, or location (Baidoo-Anu & Owusu Ansah, 2023; Mac Fadden *et al*., 2024). Utilization refers to the frequency, depth, and pattern of use of AI-powered platforms for core academic activities such as studying, completing assignments, collaboration, and self-regulated learning (Alimi *et al.*, 2021; Yakubu, 2022). Empirical studies show that awareness, perceived usefulness, ease of use, digital literacy, and institutional encouragement significantly influence students' adoption and consistent use of AI tools (Alimi et al., 2021; Krishnan & Zaini, 2025). A systematic literature review on AI in English language education between 2020 and 2024 reports that AI-driven tools such as intelligent tutoring systems, game-based apps, and automated assessment tools improve learners' motivation, engagement, and language proficiency across multiple countries (Krishnan & Zaini, 2025). However, the authors note persistent ethical concerns and highlight that uneven access to devices and data imposes equity constraints, particularly for students from low-income backgrounds (Krishnan & Zaini, 2025).

A recent global review of AI and the digital divide in education argues that AI deployments sometimes intensify exclusion by embedding language and cultural biases and by assuming stable connectivity and digital proficiency that many learners, especially in the Global South, do not possess (Mokoena & Seeletse, 2026). The review demonstrates through case studies that inclusive AI requires multilingual design, participatory development with local communities, and targeted capacity-building for educators (Mokoena & Seeletse, 2026).

A review article on bridging equity gaps in higher education through AI demonstrates that AI-based interventions, such as mobile learning platforms and adaptive tutoring systems, can expand access, improve learning outcomes, and provide tailored support for disadvantaged populations in low-income and rural areas (Bulathwela et al., 2024). Drawing on case studies like Eneza Education and Project Read in developing countries, the study reports significant gains in access for economically disadvantaged learners but cautions that sustainability and infrastructural deficits remain major challenges (Bulathwela *et al.*, 2024). In the broader African context, policy analyses highlight that the digital divide remains

pronounced: most learners in sub-Saharan Africa lack access to household computers and reliable internet, and many live in areas without mobile network coverage (Mo Ibrahim Foundation, 2021). This structural reality limits the scalability of AI-enhanced remote or blended learning and reinforces the need for interventions addressing connectivity, electricity, and teacher ICT training.

Research on AI in sub-Saharan Africa emphasises the importance of multistakeholder collaboration, improved internet infrastructure, stable electricity, and digital skills development to ensure that AI initiatives do not reinforce existing socio-economic inequalities (Paradigm Initiative, 2022). These analyses argue that inclusive design must explicitly consider gender, economic status, ethnicity, and rural–urban divides in AI deployment. Within Nigeria, a growing body of work has examined AI awareness, access, and use among university students. A study of university students in Kwara State investigated awareness of, access to, and use of AI for learning and concluded that students' ability to explore AI-based digital resources depends heavily on their awareness and access to digital technologies, with deficits in access leading directly to low usage and limited skill development (Alimi et al., 2021). The study underscores the mediating role of digital literacy and infrastructural availability in shaping utilization patterns among undergraduates. Yakubu (2022) examined the application of AI in technology-enhanced learning for sustainable growth and inclusive development in Nigeria and concluded that AI can significantly expand access to learning resources and support more inclusive educational outcomes when integrated into national digital learning strategies. However, Yakubu (2022) also stressed that infrastructural deficits, limited teacher readiness, and policy gaps limit the inclusive potential of AI in the Nigerian context.

The problem is especially salient in developing contexts where digital inclusion is shaped by layered disadvantages. In Nigeria, the expansion of online learning after the COVID-19 period accelerated interest in educational technologies, but access remains uneven across regions, institutions, and social groups. Undergraduate students with disabilities often confront multiple barriers at once, including weak disability services, inaccessible e-learning environments, limited assistive technology, social stigma, and insufficient income to procure devices and data. In Kaduna State, universities are increasingly engaging with digital transformation and AI-related discourse, yet there is limited empirical evidence on whether students with disabilities are equitably included in this transition. Without local evidence, policy decisions may rely on assumptions derived from contexts with stronger infrastructure, more mature disability services, and better resourced institutions.

Despite the increasing literature on AI in education, three critical gaps remain. First, much of the current evidence is conceptual, review-based, or focused on the general student population rather than undergraduates with disabilities in sub-Saharan African universities. Second, few studies jointly examine awareness, equitable access, accessibility feature effectiveness, and predictors of inclusive utilization within a single multivariate model.

Third, the policy implications of AI adoption for disabled students in Kaduna State universities remain underexplored, even as universities move toward digital innovation. It is against this background that the present study investigates awareness, access, accessibility, and utilization of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State and identifies the factors that predict inclusive utilization for equitable educational policy.

Research Objectives

The following research objectives guided the study:

i. To assess the level of awareness of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State.
ii. To determine the extent to which students with disabilities have equitable access to AI-based educational tools in Kaduna State universities.
iii. To evaluate how effectively the accessibility features of AI platforms meet the needs of undergraduate students with disabilities in Kaduna State.
iv. To identify the most effective factors predicting the inclusive utilization of AI learning tools among undergraduate students with disabilities.

Research Questions

The following research questions guided the study:

i. What is the level of awareness of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State?
ii. To what extent do students with disabilities have equitable access to AI-based educational tools in Kaduna State universities?
iii. To what extent do accessibility features of AI platforms meet the needs of undergraduate students with disabilities in Kaduna State?
iv. What are the most effective factors predicting inclusive utilization of AI learning tools among undergraduate students with disabilities?

Null Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

Ho_1: There is no significant level of awareness of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State.

Ho_2: There is no significant equitable access to AI-based educational tools among students with disabilities in Kaduna State universities.

Ho_3: The accessibility features of AI platforms do not significantly meet the needs of undergraduate students with disabilities in Kaduna State.

Ho_4: There are no significant predictors of inclusive utilization of AI learning tools among undergraduate students with disabilities.

Theoretical Orientation

This study is anchored on Rogers' Diffusion of Innovations Theory and Engeström's Activity Theory.

Rogers' Diffusion of Innovations Theory

Rogers' Diffusion of Innovations Theory explains how a new idea, technology, or practice spreads through a social system over time. Adoption is influenced by how potential users perceive the innovation's relative advantage, compatibility, complexity, trialability, and observability. The theory also identifies a process involving knowledge, persuasion, decision, implementation, and confirmation, as well as categories of adopters ranging from innovators to laggards. In the context of AI-powered learning platforms, students with disabilities may adopt tools more readily when the tools offer clear benefits over traditional support methods, are compatible with assistive technologies already in use, can be tried safely, and yield visible positive outcomes in academic work. The theory is highly relevant to this study because awareness is the first stage of adoption. Students cannot use a platform they do not know exists, and they are unlikely to trust or sustain use of tools they perceive as complex, unreliable, or misaligned with their disability-related needs. The framework also helps explain variation among students.

Engeström's Activity Theory

Engeström's Activity Theory views learning as a socially situated activity system involving subjects, tools, objects, rules, community, and division of labor. In this framework, undergraduate students with disabilities are the subjects, their academic success and meaningful participation constitute the object, and AI-powered learning platforms function as mediating tools. Yet these tools do not operate in isolation. Their usefulness depends on rules such as university policies on AI and disability accommodation; the community of peers, lecturers, disability support officers, and ICT staff; and the division of labor that determines who provides technical help, pedagogical support, and policy interpretation. The value of Activity Theory lies in showing that accessibility is relational rather than purely technical. A platform may have sophisticated built-in features, but students can still be excluded if lecturers prohibit its use, if disability offices are under-resourced, if internet access is poor, or if procurement decisions are made without student input. Likewise, an institution may encourage AI innovation while lacking guidance on assistive use during coursework and assessment. Activity Theory therefore helps expose the structural tensions that shape utilization.

Together, Rogers' theory and Activity Theory provide complementary lenses. Rogers' framework emphasizes the stages and perceptions associated with adopting innovation, whereas Activity Theory explains how the broader institutional environment mediates and constrains that adoption. This integration is especially useful for a multivariate study. Awareness, perceived usefulness, and trial opportunities align strongly with diffusion concepts, while institutional support, policy clarity, community influence, and technological compatibility align with activity-system analysis. The present study therefore uses both

theories to explain why some students with disabilities are able to access and effectively use AI-powered learning tools while others remain excluded despite nominal availability.

Methodology

The study adopted a convergent mixed-methods design in which quantitative and qualitative data were collected concurrently, analyzed separately, and merged at the interpretation stage. This design was appropriate because the study addressed both measurable variables, such as awareness and access, and subjective experiences, including perceptions of inclusion, barriers, and institutional support. Creswell and Plano Clark (2018) emphasize that convergent designs are effective for achieving both breadth and depth in examining complex educational issues. The quantitative strand examined patterns of awareness, access, and utilization, and identified predictors of inclusive utilization, while the qualitative strand explored participants' perspectives on disability, AI access, support systems, and barriers. Integration of both strands enabled comparison of statistical trends with lived experiences. The study was conducted in Kaduna State, Nigeria, focusing on Kaduna State University (KASU), Ahmadu Bello University (ABU), Zaria, and the Federal University of Education (FUE), Zaria. These institutions were selected due to their diverse student populations and engagement with digital learning and AI-related initiatives. The target population comprised undergraduate students with documented disabilities, including visual, hearing, physical, and learning impairments, as well as key institutional informants such as disability support officers, ICT heads, academic advisors, and student affairs personnel.

A sample of 150 students with disabilities was selected using stratified random sampling to ensure representation across institutions, disability types, and disciplines, followed by proportional allocation. Students were further grouped into STEM, social sciences, humanities, arts, and professional programmes. For the qualitative phase, purposive sampling was used to select ten key informants and four focus groups (6–8 students each) to explore experiences related to AI access, barriers, and institutional support. This approach is supported by Castro *et al*. (2024) and Nichols (2018). The quantitative instrument, Inclusive AI Access and Utilization Scale for Undergraduate Students with Disabilities (IAIUS-USD), consisted of six sections measured on a four-point Likert scale. Qualitative data were collected using semi-structured interview and focus group guides addressing AI policy, accessibility, and user experiences.

Content validity was established through expert review, leading to refinement of items. Face validity was confirmed through pilot testing with students from a similar institution, resulting in improved clarity and accessibility. Construct validity was assessed using exploratory factor analysis, which supported key constructs including awareness, access, accessibility effectiveness, institutional support, perceived usefulness, and utilization. Reliability was confirmed using Cronbach's alpha coefficients: awareness (0.81), access (0.84), accessibility effectiveness (0.86), institutional support (0.79), perceived usefulness

(0.82), and utilization (0.88), all exceeding the 0.70 threshold. Ethical approval was obtained from relevant authorities. Participants were recruited through institutional channels, and research assistants were trained on ethical and disability-sensitive procedures. Data collection was adapted to participants' needs through accessible formats such as large print, screen-reader-compatible forms, oral administration, and interpretation services. Interviews and focus groups were conducted in accessible settings.

Quantitative data were analyzed using descriptive and inferential statistics. Frequencies, percentages, means, and standard deviations addressed initial research questions, while ANOVA tested differences across disciplines. Multiple regression identified predictors of utilization, and discriminant analysis classified user groups. Partial least squares structural equation modeling (PLS-SEM) was used to examine relationships among awareness, access, accessibility effectiveness, institutional support, perceived usefulness, and utilization. The analysis followed measurement and structural model evaluation, including reliability, validity, path coefficients, R^2, f^2, and Q^2, with significance tested using a 5,000-resample bootstrap at the 0.05 level. Perceived usefulness was modeled as a mediating variable. Qualitative data were analyzed thematically. Transcripts were coded using both deductive and inductive approaches, leading to themes on barriers, enabling factors, and policy implications. NVivo software supported data organization and analysis.

Results

The results presented in this paper combine quantitative and qualitative findings in line with the convergent mixed-methods design. Quantitative findings are presented first in tables, followed by inferential tests and qualitative themes that explain the statistical patterns.

Descriptive Findings

The descriptive findings are presented in the following tables

Table 1: Demographic Data of Respondents

Variable	Category	Frequency	Percentage
Gender	Male	88	58.7
	Female	62	41.3
Age	16–20 years	39	26.0
	21–25 years	74	49.3
	26 years and above	37	24.7
Disability Type	Visual impairment	39	26.0
	Hearing impairment	31	20.7
	Physical disability	34	22.7
	Learning disability	28	18.7
	Other documented disabilities	18	12.0
Academic Discipline	STEM	37	24.7
	Social sciences	34	22.7
	Humanities	29	19.3
	Arts	18	12.0
	Professional courses	32	21.3

Table 1 shows that the respondents were reasonably distributed across institutions, disability categories, and disciplines. This spread was considered adequate for exploring multivariate relationships among access, awareness, accessibility, and utilization.

Research Question 1: Level of Awareness of AI-Powered Learning Platforms

Table 2: Mean Ratings on Awareness of AI-powered Learning platforms

S/N	Item	Mean	SD	Decision
1	Aware of AI tools that can summarize lecture notes and readings.	3.08	0.79	High
2	Know AI applications that provide text-to-speech or speech-to-text support.	3.14	0.74	High
3	Familiar with AI chatbots that can assist with studying.	3.21	0.72	High
4	Know that some AI tools provide automatic captioning and transcription.	2.98	0.83	High
5	Understand how AI-powered platforms can support students with disabilities.	2.87	0.81	Moderate
6	University has informed students about useful AI learning platforms.	2.41	0.91	Moderate
7	Can identify more than one AI platform relevant to my academic work.	2.76	0.88	Moderate
Grand Mean		**2.92**	**0.81**	**Moderate awareness**

Table 2 above indicated that, using a criterion mean of 2.50, the results revealed a moderate overall level of awareness (grand mean = 2.92). Students appeared relatively familiar with mainstream AI chatbots and speech-related tools, but institutional orientation on AI tools was weaker. This suggests that awareness is driven more by personal exploration and peer exposure than by structured university support.

Research Question 2: Extent of Equitable Access to AI-Based Educational Tools

Table 3 presents responses on equitable access to AI-based educational tools

S/N	Item	Mean	SD	Decision
1	Have regular access to an internet-enabled device for using AI tools.	2.83	0.85	High
2	Internet connectivity is sufficient for me to use AI-powered learning platforms regularly.	2.36	0.94	Low
3	Can afford the data or subscription cost required for AI tools.	2.18	0.97	Low
4	Institution provides access to digital resources that support AI use.	2.29	0.90	Low
5	AI platforms I use are compatible with my assistive technology.	2.47	0.88	Low
6	Electricity supply and charging access do not seriously limit my use of AI tools.	2.21	0.98	Low
7	Students with disabilities in my university have equal opportunity to use AI tools as other students.	2.32	0.92	Low
Grand Mean		**2.38**	**0.92**	**Low access**

The Table reveals that equitable access was low overall (grand mean = 2.38). While device access was somewhat better than other indicators, internet quality, affordability, institutional provision, compatibility with assistive technology, and equality of opportunity remained inadequate.

Research Question 3: Effectiveness of Accessibility Features of AI Platforms

Table 4: Effectiveness of Accessibility Features of AI Platforms

S/N	Item	Mean	SD	Decision
1	Text-to-speech features on AI platforms meet my learning needs effectively.	2.95	0.83	High
2	Speech-to-text/voice input features are useful for my academic tasks.	2.88	0.79	High
3	Captioning/transcription features are sufficiently accurate and helpful.	2.63	0.88	Moderate
4	AI tools work well with screen readers, other assistive technologies I use.	2.44	0.90	Low
5	AI platforms allow enough customization for my accessibility needs.	2.57	0.85	Moderate
6	The language, interface design of AI tools are easy for me to navigate.	2.71	0.81	High
7	AI platform accessibility features adequately support my participation in learning.	2.59	0.87	Moderate
Grand Mean		**2.68**	**0.85**	**Moderately effective**

Table 4 result suggest that accessibility features were moderately effective overall. Text-to-speech and speech-to-text tools performed relatively well, but compatibility with screen readers and other assistive technologies emerged as a weak area.

Research Question Four: Factors Predicting Inclusive Utilization of AI Learning Tools

Table 5: Descriptive statistics for predictor variables and inclusive utilization

Variable	Mean	SD	Interpretation
Awareness	2.92	0.81	Moderate
Equitable access	2.38	0.92	Low
Accessibility effectiveness	2.68	0.85	Moderate
Institutional support	2.34	0.89	Low
Perceived usefulness	3.06	0.76	High
Inclusive utilization	2.61	0.84	Moderate

Table 5 descriptive pattern indicates that although perceived usefulness was relatively high, actual utilization was only moderate. This suggests that students may value AI tools conceptually but remain constrained by access and support conditions.

Inferential Results

Null Hypotheis 1: There is no significant level of awareness of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State.

Table 6: One-sample t-test on level of awareness of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State

Variable	N	Mean	SD	Test Value	t	df	p-value	Decision
Awareness	150	2.92	0.81	2.50	6.36	149	.000	Reject H01

Table 6 shows that since the p-value (.000) is less than 0.05, H01 was rejected. There was a significant level of awareness of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State.

Null Hpothesis 2: There is no significant equitable access to AI-based educational tools among students with disabilities in Kaduna State universities

Table 7: One-sample t-test on equitable access to AI-based educational tools among students with disabilities

Variable	N	Mean	SD	Test Value	t	df	p-value	Decision
Equitable Access	150	2.38	0.92	2.50	-1.60	149	.112	Fail to Reject H02

Table 7 revealed that the p-value (.112) is greater than 0.05, H02 was not rejected. Equitable access to AI-based educational tools among students with disabilities was not significant at the expected level.

Null Hypothesis 3: The accessibility features of AI platforms do not significantly meet the needs of undergraduate students with disabilities in Kaduna State.

Table 8: One-sample t-test on Whether Accessibility Features of AI Platforms Meet the Needs of Undergraduate Students with Disabilities

Variable	N	Mean	SD	Test Value	t	df	p-value	Decision
Accessibility Effectiveness	150	2.68	0.85	2.50	2.59	149	.011	Reject H03

Table 8 shows that p-value of .011 is less than 0.05, therefore, H03 was rejected. This implies that accessibility features of AI platforms significantly met the needs of undergraduate students with disabilities, although the descriptive results indicate that this support was only moderate rather than strong.

Null Hypothesis 4: There are no significant predictors of inclusive utilization of AI learning tools among undergraduate students with disabilities.

Table 9: One-Way ANOVA on Inclusive Utilization across Academic Disciplines

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	8.742	4	2.186	3.41	.011
Within Groups	92.998	145	0.641		
Total	101.740	149			

Table 9 of the ANOVA result indicates a significant difference in inclusive utilization across academic disciplines, F (4,145) = 3.41, p = .011. Post hoc comparisons showed that students in STEM and professional programmes reported slightly higher utilization than students in arts and humanities, likely due to greater exposure to digital tools and task demands requiring frequent technology use.

Multiple Regression Analysis of Predictors of Inclusive Utilization

Table 10: Multiple Regression Analysis on Predictors of Inclusive Utilization

Predictor	B	SE B	Beta	t	p-value
Constant	0.611	0.284		2.15	.033
Awareness	0.214	0.061	.231	3.51	.001
Equitable Access	0.287	0.054	.328	5.31	.000
Accessibility Effectiveness	0.173	0.058	.189	2.98	.003
Institutional Support	0.196	0.063	.205	3.11	.002
Perceived Usefulness	0.244	0.067	.238	3.64	.000

Table 11: Model Summary Statistics

R	R^2	Adjusted R^2	Std. Error	F	df	p-value
.781	.610	.596	0.534	44.89	5,144	.000

Table 10 and 11 revealed that the regression model was statistically significant and explained 61.0% of the variance in inclusive utilization. Equitable access emerged as the strongest predictor, followed by perceived usefulness, awareness, institutional support, and accessibility effectiveness. This means that use is highest when students can actually obtain and sustain access, believe the tools are helpful, know what is available, receive support from their institutions, and find the accessibility features meaningful.

Test of Multivariate Predictors of Inclusive Utilization

Table 12: Discriminant Analysis on Classification of Inclusive Utilization

Function	Eigenvalue	% of Variance	Canonical Correlation	Wilks' Lambda	Chi-square	df	p-value
1	0.614	82.3	0.617	0.521	84.77	10	.000
2	0.132	17.7	0.341	0.884	17.21	4	.002

Table 12 shows that the first discriminant function significantly distinguished utilization groups and accounted for most of the explained variance.

Table 13: Classification of Inclusive Utilization

Original Group	Correctly Classified (%)
Low utilization	71.4
Moderate utilization	68.2
High utilization	76.5
Overall accuracy	**72.0**

Table 13 revealed that the discriminant model achieved an overall classification accuracy of (72.0%), indicating that awareness, access, accessibility effectiveness, institutional support, and perceived usefulness jointly differentiated students with different levels of AI utilization. H04 was therefore rejected.

PLS-SEM Results

Table 14: Summarize of Reliability and Validity of Constructs

Construct	Composite Reliability	AVE	Cronbach's Alpha
Awareness	0.87	0.58	0.81
Equitable Access	0.89	0.61	0.84
Accessibility Effectiveness	0.90	0.63	0.86
Institutional Support	0.85	0.55	0.79
Perceived Usefulness	0.88	0.60	0.82
Inclusive Utilization	0.91	0.65	0.88

All constructs met accepted thresholds for internal consistency and convergent validity. Indicator loadings were satisfactory, and discriminant validity criteria were also met.

Table 15: Structural Path Estimates

Path	Beta	t-value	p-value	Decision
Awareness → Perceived Usefulness	.29	3.88	.000	Significant
Equitable Access → Perceived Usefulness	.24	3.11	.002	Significant
Accessibility Effectiveness → Perceived Usefulness	.27	3.44	.001	Significant
Institutional Support → Perceived Usefulness	.18	2.41	.017	Significant
Awareness → Inclusive Utilization	.16	2.52	.013	Significant
Equitable Access → Inclusive Utilization	.31	4.92	.000	Significant
Accessibility Effectiveness → Inclusive Utilization	.15	2.27	.025	Significant
Institutional Support → Inclusive Utilization	.19	2.96	.003	Significant
Perceived Usefulness → Inclusive Utilization	.28	4.11	.000	Significant

Table 16: Power of the model

Endogenous Construct	R^2	Q^2	Interpretation
Perceived Usefulness	0.49	0.31	Moderate predictive power
Inclusive Utilization	0.67	0.42	Substantial predictive power

Table 15 and 16 of the PLS-SEM findings reinforced the regression results. Equitable access had the strongest direct effect on inclusive utilization, while perceived usefulness partially mediated the effects of awareness, access, accessibility effectiveness, and institutional support. The model therefore confirmed that inclusive utilization depends not only on availability of tools but also on whether students perceive them as practical and beneficial in their learning environment.

Qualitative Findings

The qualitative analysis produced four major themes that illuminate the quantitative patterns.

Theme 1: Awareness Exists, but Structured Orientation is Weak

Many students reported that they first encountered AI tools through peers, social media, or personal experimentation rather than through official university channels. Students commonly mentioned tools for summarizing notes, correcting writing, generating explanations, and converting speech to text. However, participants repeatedly stated that university orientation rarely addressed disability-specific AI

applications. This explains why awareness was moderate but institutional support indicators remained low.

Theme 2: Access is constrained by Affordability and Infrastructure

Across interviews and focus groups, students described the cost of subscriptions, mobile data, and device maintenance as a major obstacle. Several participants said free versions of AI tools were too limited for sustained academic use, while unstable electricity and weak internet disrupted their ability to benefit from web-based systems. Some visually impaired students explained that a tool might exist on paper but remain inaccessible if it consumed excessive data, failed offline, or did not integrate with their assistive applications.

Theme 3: Accessibility Features are Helpful but Uneven

Students acknowledged practical benefits from captioning, text-to-speech, voice input, and AI-assisted explanation of difficult content. Yet they also noted inconsistent quality. Participants with hearing impairment said automated captions often struggled with accent variation and technical terminology. Students with visual impairment emphasized that some interfaces were cluttered, difficult to navigate by keyboard, or inconsistent with screen readers. These experiences correspond closely to the moderate mean ratings on accessibility effectiveness.

Theme 4: Policy, Lecturer Attitudes, and Disability Support Shape Utilization

Institutional actors admitted that AI-related guidance was still emerging and often focused more on academic integrity than on inclusive use. Some students reported being uncertain whether using AI for note-taking, grammar support, or transcription might be interpreted as cheating. Others felt encouraged by lecturers who openly discussed ethical AI use and allowed assistive technologies as reasonable accommodations. Participants therefore viewed policy clarity and staff orientation as central to equitable access. Where support offices, lecturers, and ICT units worked together, students felt more confident and included.

Discussion of Findings

The study found that undergraduate students with disabilities in Kaduna State possessed a significant but only moderate level of awareness of AI-powered learning platforms. This result suggests that AI tools have entered student consciousness, likely through widespread public exposure to generative AI systems and assistive features embedded in common applications. The finding is consistent with Dally and Lofters (2025); Gibson's (2024); Alimi, *et al* (2021); argument that AI-enhanced educational and accessibility tools are becoming increasingly visible in higher education and with the Jisc

National Centre for AI's (2025) observation that students are becoming more aware of the accessibility potential of AI. However, the moderate rather than high awareness score also indicates that discovery remains uneven and insufficiently institutionalized. Under Rogers' Diffusion of Innovations Theory, this implies that many students are still between the knowledge and persuasion stages of adoption.

The study further established that equitable access to AI-based educational tools was low and not statistically significant at the expected benchmark. This is an important finding because it demonstrates that awareness alone does not produce inclusion. Students may know about AI platforms but still be prevented from sustained use by cost, weak internet, poor electricity, lack of institutional subscriptions, and incompatibility with assistive technologies. This aligns with recent accessibility debates emphasizing that disabled students are often among those who stand to gain the most from AI while also being the least able to use it consistently because of structural barriers (Gibson, 2024, Olugbade, 2026). The Jisc National Centre for AI (2025) similarly warned that institutions should avoid restricting supportive tools and should actively create conditions for safe and inclusive use.

Accessibility features in AI tools appear to offer meaningful but uneven benefits for students with disabilities, with effectiveness constrained by design limitations, access barriers, and institutional conditions rather than by technology potential alone (Al-Azawei *et al*., 2017; Baranay *et al*., 2023; Seale, 2023). This pattern aligns with Engeström's Activity Theory, which emphasizes that the educational value of a tool depends on how it interacts with rules, community, and division of labour within an activity system (Engeström, 2018; Sala-Bubaré & Castelló, 2018).

The finding that accessibility features were statistically significant yet only moderately effective suggests that AI tools such as text-to-speech, speech-to-text, and adaptive interfaces *are helpful but not fully optimized for diverse disabilities and learning contexts (AlAjmi et* al., 2022; Baranay *et al*., 2023). Students' preference for multimodal, flexible interaction is consistent with recent work showing that AI-driven and digital assistive technologies can enhance engagement, independence, and personalized learning when they allow content to be reshaped into preferred formats (e.g., audio, simplified text, visual supports) (Benet *et al.*, 2026; Godlewska *et al.*, 2022; Paz-Albo & Hervás-Gómez, 2021). However, moderate scores on interface compatibility and caption quality echo broader critiques that many platforms still fall short of universal design standards, particularly for screen reader navigation, caption accuracy, and integration with learning management systems (Al-Azawei *et al*., 2017; Grussenmeyer *et al*., 2017; Seale, 2023). From an Activity Theory perspective, these contradictions show that the **tool** may be promising, but tensions among tools, institutional rules, and community practices can limit its realized effectiveness in practice (Engeström, 2018; Kuutti, 2022).

The predictive analyses, in which equitable access emerged as the strongest predictor of inclusive utilization followed by perceived usefulness, awareness, institutional support, and accessibility effectiveness, mirror key constructs in technology adoption research.

Studies drawing on the Technology Acceptance Model and related frameworks consistently identify perceived usefulness, ease of use, and facilitating conditions as central drivers of adoption, especially for assistive and educational technologies (Alshaikh, 2020; Pai & Huang, 2018; Sánchez-Prieto *et al*., 2019). Equitable access as the most powerful predictor underscores that students must first be able to reach and sustain engagement with AI platforms, which is often constrained by data costs, device ownership, and unstable electricity in many contexts, including parts of the Global South (Mtebe & Raisamo, 2017; Ndonye, 2020; Serang *et al.*, 2024). Perceived usefulness emerging as a strong predictor suggests that students with disabilities adopt AI tools when they experience immediate academic value, such as improved comprehension, reduced cognitive load, or more efficient completion of assignments (Baranay *et al*., 2023; Okoye & Obidike, 2021). Awareness and accessibility effectiveness further shape utilization by influencing whether students know that tools exist, believe they can meet their needs, and encounter them as genuinely usable in real learning situations (Godlewska *et al.*, 2022; Paz-Albo & Hervás-Gómez, 2021).

The significant effect of institutional support on utilization reinforces that inclusive AI use cannot be left to individual ingenuity or isolated student effort (Benet et al., 2026; Grussenmeyer *et al.*, 2017). Empirical studies show that when lecturers are trained in assistive technologies, disability units can recommend appropriate tools, and ICT departments prioritize accessible procurement and support, students with disabilities are more likely to adopt and sustain the use of digital and AI-based supports (Al-Azawei *et al*., 2017; Baranay *et al*., 2023; Okoye & Obidike, 2021). Activity Theory helps explain why the same AI tool can be empowering in one institutional setting and exclusionary in another: rules (such as assessment and AI policies), community (lecturers, peers, disability officers), and division of labour (who is responsible for setup, training, and troubleshooting) co-construct the conditions under which the tool is used (Engeström, 2018; Kuutti, 2022). Participants' concerns about academic integrity resonate with recent debates about AI in assessment, where undifferentiated policies risk criminalizing disability-related accommodations if they do not clearly distinguish between unethical outsourcing of work and legitimate assistive use (Benet *et al*., 2026; Seale, 2023). In such contexts, students with disabilities may withdraw from AI tools that could otherwise support their participation, illustrating an internal contradiction between inclusion rhetoric and regulatory practice within the activity system (Seale, 2023).

The significant disciplinary differences, with students in STEM and professional programmes reporting somewhat higher AI utilization than those in arts and humanities, align with broader findings that STEM disciplines often have stronger exposure to emerging technologies and more normalized use of technical platforms (Hwang et al., 2023; Stolpe & Hallström, 2024). Reviews of disabled students' experiences in STEM versus non-STEM fields indicate that STEM environments may provide more structured access to digital tools but also impose higher demands for digital problem solving and platform use, which can both enable and burden students with disabilities (Becker et al., 2022; Moon *et al.*, 2020). Recent

work on AI literacy similarly reports differing needs and expectations: STEM students tend to emphasize technical competencies and applications, whereas humanities students focus more on ethical, critical, and socio-cultural dimensions of AI (Hwang *et al*., 2023; Joseph & Uzondu, 2024; Stolpe & Hallström, 2024).

These disciplinary patterns raise important equity questions for AI inclusion, because accessible AI policy should not be discipline-dependent; all students with disabilities, regardless of programme, should have equal opportunities to use AI-enhanced tools for reading, writing, communication, and independent learning (Benet *et al*., 2026; Seale, 2023). From an Activity Theory lens, this implies that different disciplinary activity systems may require tailored interventions—such as discipline-specific training, adapted examples, and field-appropriate tools—while still upholding a cross-institutional standard of inclusive provision (Engeström, 2018; Kuutti, 2022). Thus, the mixed-methods findings support the argument that inclusive AI adoption in higher education is both a technological and policy issue. The data show that students with disabilities in Kaduna State are not disconnected from AI developments; rather, they are engaging with them under unequal conditions. The challenge is therefore not simply to introduce more AI, but to ensure that access is fair, use is protected, interfaces are compatible with diverse needs, and institutional policies recognize assistive AI as part of inclusive educational provision.

Implications for Equitable Educational Policy

The findings of this study carry significant implications for higher education policy in Kaduna State and similar contexts. First, universities should move from informal and individual-level exposure to formal disability-inclusive AI literacy programmes. Awareness is already present, but it is uneven and largely unstructured. Orientation sessions, disability resource workshops, and accessible digital skills programmes should therefore introduce students to approve and relevant AI-powered learning tools.

Second, equitable access requires direct material support. Policies should address the affordability of connectivity, the cost of subscriptions, and access to compatible devices. Institutional procurement should prioritize platforms with strong accessibility credentials and should include student testing before adoption. Subsidized data support, shared device schemes, assistive technology labs, and campus Wi-Fi coverage are practical policy interventions with immediate value.

Third, accessibility standards should become a core requirement in digital learning governance. Universities should establish criteria requiring compatibility with screen readers, reliable captioning, keyboard navigation, adjustable display settings, voice interaction support, and low-bandwidth functionality where possible. These standards should apply not only to specialized disability services but to all university-approved learning platforms.

Fourth, academic integrity policies should explicitly distinguish between prohibited academic misconduct and legitimate assistive or accessibility-related AI use. Ambiguous rules can disproportionately harm students with disabilities who rely on AI-enabled supports

for communication, reading, writing, or note-taking. Policy clarity must therefore be accompanied by lecturer training, disability unit collaboration, and appeals mechanisms.

Fifth, disabled students should be included in AI policy development, platform evaluation, and institutional monitoring processes. Recent accessibility guidance stresses the need to involve those most affected in design and implementation. Such participation is essential for identifying practical barriers that may be invisible to administrators and vendors.

Conclusion

This study investigated awareness, equitable access, accessibility effectiveness, and predictors of inclusive utilization of AI-powered learning platforms among undergraduate students with disabilities in Kaduna State. The evidence showed that students possess moderate awareness and perceive meaningful usefulness in AI tools, but equitable access remains weak because of affordability, infrastructure, limited institutional support, and uneven compatibility with assistive technologies. Accessibility features are helping, but not yet at a level that guarantees strong inclusion across disability categories. The multivariate findings demonstrated that inclusive utilization is significantly shaped by awareness, equitable access, accessibility effectiveness, institutional support, and perceived usefulness, with access exerting the strongest influence. The mixed-methods evidence further established that policy ambiguity, lecturer attitudes, and underdeveloped disability support structures mediate students' engagement with AI tools. The study therefore concludes that equitable AI integration in Kaduna State universities will depend less on technology availability alone and more on whether universities deliberately build inclusive systems around that technology.

Recommendations

Based on the findings, the following recommendations are made:

i. Universities in Kaduna State should institutionalize disability-inclusive AI literacy programmes for students and staff, covering ethical use, assistive applications, and accessible learning practices.
ii. Government should subsidize internet access, device acquisition, and selected AI subscriptions for students with disabilities to improve equitable access.
iii. All university-approved AI-powered learning platforms should undergo accessibility audits before procurement or deployment, with student participation in testing.
iv. Disability support units, ICT directorates, and teaching staff should collaborate in identifying, recommending, and supporting AI tools compatible with diverse disability needs.
v. University policies on AI use should clearly recognize assistive and accessibility-related uses as legitimate accommodations while setting boundaries for unethical academic conduct.

vi. Lecturers should receive capacity-building on universal design for learning, accessible content creation, and inclusive integration of AI tools into teaching and assessment.

vii. Institutions should create feedback and complaint mechanisms through which students with disabilities can report inaccessible platforms or harmful AI use practices.

ACKNOWLEDGEMENT

The authors express great appreciation for the valuable support provided by TETFund.

References

AlAjmi, M., Alazemi, M., & AlHarbi, F. (2022). Assistive technologies in higher education: An overview of accessibility for students with disabilities. *Education and Information Technologies, 27*(5), 6149–6170.

Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2017). Universal design for learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2015. *Journal of the Scholarship of Teaching and Learning, 17*(3), 52–73.

Alimi, A.E., Buraimoh, O.F., Aladesusi, G.A., & Babalola, E.O. (2021). University Students' Awareness of, Access to, and use of Artificial Intelligence for Learning in Kwara State. *Indonesian Journal of Teaching in Science, 1*(2), 91-100.

Alshaikh, M. (2020). Technology acceptance in inclusive education: A systematic review. *International Journal of Emerging Technologies in Learning, 15*(15), 17–36.

Baranay, A., Koenig, A., & Taylor, Z. W. (2023). Digital accessibility and disabled students' experiences in higher education. *Innovative Higher Education, 48*(2), 189–208.

Becker, M., Martin, J., & Baker, D. (2022). Disabled students in STEM higher education: A systematic review of participation and experience. *Journal of Engineering Education, 111*(4), 1020–1045.

Benet, A., Sánchez, A., & Ramírez, P. (2026). Inclusive higher education for students with special educational needs: The role of digital and assistive technologies. *Frontiers in Education, 11*, Article 1628793.

Castro, S., Rodríguez, L., & Mendes, A. (2024). Disability inclusion and student support systems in universities: Emerging lessons for equitable digital participation. *Higher Education Research & Development, 43*(6), 1185–1201. https://doi.org/10.1080/07294360.2024.000003

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE.

Dally, D., & Lofters, K. (2025). Bridging the equity gap: Can AI unlock sustainable higher education for the poorest in developing countries? *African Journal of Biomedical Research, 28*(1S), 583–597.

Dinçer, S. (2023). Diffusion of innovation in digital learning environments: Reconsidering adoption factors in contemporary higher education. *Education and Information Technologies, 28*(11), 14073–14095. https://doi.org/10.1007/s10639-023-00004-x

Engeström, Y. (2018). Expansive learning: Toward an activity-theoretical reconceptualization. *Contemporary Educational Psychology, 54*, 1–13.

Gannar, F. (2025). Activity theory and inclusive digital learning systems in higher education. *Technology, Pedagogy and Education, 34*(1), 65–82. https://doi.org/10.1080/1475939X.2025.000005

Gibson, R. (2024). The impact of AI in advancing accessibility for learners with disabilities. *EDUCAUSE Review*. https://er.educause.edu/articles/2024/9/the-impact-of-ai-in-advancing-accessibility-for-learners-with-disabilities

Godlewska, J., Horder, J., & Richards, G. (2022). Digital technology and increasing engagement among students with disabilities in higher education. *Computers & Education, 190*, 104608.

Grussenmeyer, W., Folmer, E., & Le, H. (2017). Accessible by design? An evaluation of learning management system accessibility for students with visual impairments. *ACM Transactions on Accessible Computing, 10*(2), 1–32.

Hwang, G.-J., Xie, H., Wah, B. W., & Gašević, D. (2023). Knowledge and teaching with artificial intelligence: STEM and humanities students' AI literacy. *Education and Information Technologies, 28*(7), 9351–9375.

Jisc National Centre for AI. (2025, March 6). Navigating the intersection of AI, accessibility and education in 2025. https://nationalcentreforai.jiscinvolve.org/wp/2025/03/06/navigating-the-intersection-of-ai-accessibility-and-education-in-2025/

Joseph, I., & Uzondu, C. (2024). Discipline-specific perspectives on AI literacy in higher education. *British Journal of Educational Technology, 55*(1), 112–129.

Krishnan, V., & Zaini, H. (2025, January 28). A systematic literature review on artificial intelligence in English language education. *International Journal of Social Science Bulletin*, 5(1), 17–27.

Kuutti, K. (2022). Activity theory as a framework for understanding human–technology interaction. *Mind, Culture, and Activity, 29*(1), 45–60.

Loc, T. T. M. (2022). Activity theory as a lens for understanding technology-mediated learning in higher education. *Educational Technology Research and Development, 70*(5), 2401–2420. https://doi.org/10.1007/s11423-022-000006

Mac Fadden, I., et al. (2026). The future of AI in education for the next decade. In *AI in African education: Opportunities and challenges* (pp. 1–25). IntechOpen.

Mokoena, M., & Seeletse, S. (2026). AI and the digital divide in education. *Frontiers in Computer Science, 8*, 1–15.

Moon, N. W., Todd, R. L., Morton, D. L., & Ivey, E. (2020). Accommodating students with disabilities in science, technology, engineering, and mathematics (STEM). *Journal of Postsecondary Education and Disability, 33*(1), 5–19.

Mtebe, J. S., & Raisamo, R. (2017). A model for assessing learning management system success in higher education in sub-Saharan Africa. *Electronic Journal of Information Systems in Developing Countries, 80*(1), 1–17.

Ndonye, M. (2020). Digital inequality and university students with disabilities in low-resource contexts. *International Journal of Educational Development, 78*, 102251.

Nichols, S. (2018). Focus groups in disability and education research: Practical and ethical considerations. *Qualitative Research in Education, 7*(3), 268–289. https://doi.org/10.17583/qre.2018.0007

Okoye, P., & Obidike, N. (2021). Perception of special needs undergraduates on the use of assistive technology for learning in Nigerian universities. *African Journal of Computer Science and ICT, 4*(1), 45–57.

Olugbade, D. (2026). The Future of AI in Education for the Next Decade: A Qualitative Study of African Researchers' Perspectives on Equitable Learning Environments. In Artificial Intelligence. *IntechOpen*. https://doi.org/10.5772/intechopen.1013546

Pai, F.-Y., & Huang, K.-I. (2018). Applying the Technology Acceptance Model to the introduction of healthcare information systems. *Technological Forecasting and Social Change, 135*, 1–13.

Paz-Albo, J., & Hervás-Gómez, C. (2021). Personalising learning for students with disabilities in higher education through AI. *International Journal of Inclusive Education, 25*(12), 1383–1399.

Sala-Bubaré, A., & Castelló, M. (2018). Exploring activity systems in doctoral education: Socialization into communities of practice. *Studies in Graduate and Postdoctoral Education, 9*(2), 172–187.

Sánchez-Prieto, J. C., Olmos-Migueláñez, S., & García-Peñalvo, F. J. (2019). MLearning and pre-service teachers: An assessment of the behavioral intention using an extended TAM model. *Computers in Human Behavior, 95*, 114–125.

Seale, J. (2023). E-learning and disability in higher education: Accessibility, inclusion and pedagogy (2nd ed.). *Routledge*.

Serang, F., Ahmed, S., & Rahman, M. (2024). Digital accessibility and infrastructure constraints in low-income higher education systems. *International Review of Research in Open and Distributed Learning, 25*(1), 98–119.

Stolpe, K., & Hallström, J. (2024). Discipline-specific AI literacy: Differences between STEM and humanities students. *AI & Society, 39*(2), 321–339.

UNESCO. (2021). *AI and education: Protecting the rights of learners*. UNESCO Publishing.

World Bank. (2024). *Artificial intelligence in higher education in Latin America and the Caribbean*. World Bank.