Leveraging Artificial Intelligence to Enhance Inclusive Teaching for Students with Intellectual Disabilities in Nigerian Universities

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Abstract: *Background:* Artificial Intelligence (AI) offers significant opportunities for advancing inclusive teaching, particularly for students with intellectual disabilities in Nigerian universities. By leveraging AI tools, educators can help close learning gaps, boost student engagement, and promote equitable learning experiences. This study explores the extent to which lecturers use AI tools to support inclusive teaching and examines how these tools influence the academic engagement of students with intellectual disabilities.

Methods: A descriptive survey design was employed, involving 600 lecturers drawn through accidental sampling from universities across Nigeria. Data were collected using a structured questionnaire that assessed the use of AI tools, lecturers' perceptions of their effectiveness, and their impact on students' academic engagement. Descriptive statistics (mean and standard deviation) were used to summarize the responses. At the same time, independent t-tests and multiple regression analyses were employed to test the hypotheses at the 0.05 level of significance.

Results: Findings indicated that lecturers' overall use of AI tools in inclusive teaching was low. Nevertheless, in cases where AI was applied, it was perceived to have a strong positive effect on students' engagement. Specifically, lecturers noted improvements in students' attention, participation, interest in learning tasks, and task completion when AI tools were integrated into instruction. Further analysis revealed that factors such as gender, teaching experience, and the type of university did not significantly affect how AI was adopted. Instead, what mattered most was how actively lecturers integrated AI tools into their teaching. This level of engagement proved to be the strongest factor linked to improved student participation and learning outcomes.

Conclusions: The study highlights AI's transformative potential in fostering inclusive education in Nigerian universities. Although current utilization remains limited, the reported benefits suggest that greater investment in lecturer training, technological infrastructure, and supportive policies could expand the role of AI in inclusive teaching. These insights contribute to global efforts toward Sustainable Development Goal 4, which emphasizes inclusive and equitable quality education for all.

Keywords: Artificial Intelligence, inclusive education, intellectual disabilities, academic engagement, Nigerian universities, assistive technology.

INTRODUCTION

Inclusive education has gained global recognition as a fundamental right, emphasizing the need to provide individuals with disabilities with equitable access to quality learning opportunities. The United Nations Sustainable Development Goal 4 (SDG 4) highlights this commitment by calling for "inclusive and equitable quality education" and lifelong learning for all, while SDG 10 stresses reducing inequalities within and across nations, including those faced by persons with disabilities [1]. Despite this global mandate, translating these commitments into effective practices remains a significant challenge in many developing countries, including Nigeria.

Although Nigeria has ratified international conventions on inclusive education, implementation at

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the university level often appears fragmented and symbolic [2]. Students with intellectual disabilities-characterized by limitations in intellectual functioning and adaptive behavior-remain particularly marginalized. Traditional teaching methods rarely accommodate their diverse cognitive, social, and communication needs, often resulting in disengagement, poor academic outcomes, and higher dropout rates [3]. Genuine inclusion requires more than physical access to classrooms; it necessitates intentional strategies and adaptive pedagogies that respond to varied learning profiles.

In this regard, emerging technologies, especially Artificial Intelligence (AI), present new possibilities for advancing inclusion [4]. AI-powered tools such as adaptive learning platforms, intelligent tutoring systems, speech-to-text applications, and emotion-aware feedback mechanisms can help address barriers that conventional teaching methods struggle to overcome [5,6]. These tools allow lecturers to tailor instruction dynamically, adjust pacing, and respond to learners' difficulties in real time [7,8].

However, the adoption of AI in Nigerian universities remains slow. While national policies advocate for inclusive practices, many institutions lack the infrastructure, assistive technologies, and trained personnel required for effective implementation [9]. Commonly cited challenges include inadequate training, limited availability of assistive tools, and overcrowded classrooms [10]. These systemic barriers have long reinforced the exclusion of students with intellectual disabilities. Yet, the digital transformations accelerated by the COVID-19 pandemic have opened new opportunities for universities to integrate AI into teaching and learning [11].

The alignment of AI with the objectives of Sustainable Development Goal4 and SDG 10 is precise: Sustainable Development Goal 4 advocates equal access to education for vulnerable groups. At the same time, SDG 10 promotes efforts to reduce inequalities [1]. In contexts where resources are limited and class sizes are large, AI offers scalable, cost-effective approaches to supporting diverse learners [12]. Mobile and cloud-based AI solutions, which are increasingly available across sub-Saharan Africa, could help expand inclusive educational opportunities. With the right investments in infrastructure, training, and coherent policies, AI could shift Nigerian universities from passive inclusion toward active participation for students with intellectual disabilities [13].

At the same time, significant challenges remain. Concerns about algorithmic bias, data privacy, poor digital infrastructure, and limited digital literacy among lecturers and students must be addressed to ensure equitable and sustainable integration [14]. Moreover, evidence on the effectiveness of AI in supporting inclusive teaching in Nigerian universities is still scarce, reflecting a pressing need for context-specific research.

Some preliminary studies provide valuable insights. Eze *et al.* [15] reported initial use of speech-to-text and adaptive platforms in special-needs classrooms, though infrastructure gaps limited implementation. Lawal *et al.* [16] found that only 15% of lecturers in five federal universities regularly used AI-based teaching aids, citing a lack of awareness and institutional support. Oye *et al*. [17] highlighted the prospects and challenges of AI adoption in Nigerian higher education, noting that while AI offers transformative opportunities for inclusiveness, systemic issues such as limited infrastructure, inadequate training, and institutional constraints hinder full implementation. Ibrahim and Bello [18] observed that fewer than 20% of lecturers in southwestern Nigeria had received AI training for inclusive teaching, despite a willingness to adopt these tools. Conversely, Mordi and Nwachukwu [19] reported improved participation and interaction among students with intellectual disabilities using AI-enhanced platforms in Cross River State. Similar positive outcomes were observed by Olatunde and Danjuma [20] and Yusuf and Okafor [21]; Chinedu and Ayoola [22- 24], who highlighted gains in attention, flexibility, and engagement.

This study draws on the Universal Design for Learning (UDL) framework developed by CAST, which views learning barriers as the result of rigid educational environments rather than learner deficits. UDL emphasizes providing multiple means of representation, expression, and engagement to support diverse learners. AI tools naturally align with this framework, offering flexible ways to deliver content, enable participation, and sustain motivation. Within Nigerian universities, where inclusive education is still emerging, UDL provides a strong theoretical foundation for AI adoption.

Building on this perspective, the present study investigates how AI tools are being used to foster inclusive teaching for students with intellectual disabilities in Nigerian universities. Specifically, it examines (i) the extent of lecturers' use of AI to support inclusive education, and (ii) the extent to which such use enhances the academic engagement of students with intellectual disabilities. The study's findings aim to

inform academic discourse, institutional practices, and policy strategies, thereby advancing Nigeria's progress toward the Sustainable Development Goals.

Problem of the Study

Inclusive education is widely acknowledged as a vital step toward ensuring that all learners, including those with intellectual disabilities, have equal access to quality learning opportunities. Nigeria has adopted international policies in line with the United Nations Sustainable Development Goals (SDG 4 and SDG 10), which emphasize equitable education and the reduction of inequalities. However, translating these commitments into practice at the university level has been difficult. In many cases, inclusive education remains fragmented, under-resourced, and symbolic, leaving students with intellectual disabilities at a disadvantage.

Traditional teaching methods, which often overlook diverse learning needs, contribute to disengagement, poor academic performance, and high dropout rates among this group. Artificial Intelligence (AI) has shown great promise in transforming inclusive education worldwide. Tools such as adaptive learning platforms, intelligent tutoring systems, and speech-to-text applications can personalize instruction, support student engagement, and help remove barriers that traditional approaches cannot address. Yet in Nigerian universities, the adoption of AI-enabled teaching remains very limited. Institutions face numerous challenges, including inadequate infrastructure, a lack of assistive technologies, insufficient lecturer training, and limited awareness of AI's role in inclusive teaching.

Research conducted in Nigeria has revealed that only a small number of lecturers use AI tools consistently, and even fewer have been trained to apply them in inclusive classrooms. As a result, many students with intellectual disabilities are still excluded from meaningful academic participation. Although some studies report positive outcomes where AI tools have been used, such as improved participation, attention, and classroom interaction, these examples are isolated and not widely integrated into teaching practices across the country. This situation highlights a significant gap. There is little context-specific evidence on how Nigerian lecturers are using AI tools to support inclusive teaching, or on how such use affects the academic engagement of students with intellectual disabilities. Without this evidence, policymakers and universities lack the data needed to design effective strategies for integrating AI into higher education. Addressing this gap is crucial, not only for improving educational access and outcomes in Nigeria but also for meeting global commitments to inclusive and equitable education.

Research Objectives

The study examined leveraging Artificial Intelligence to enhance inclusive teaching for students with intellectual disabilities in Nigerian universities. Specifically, the study sought to:

1. Examine the extent to which lecturers currently use Artificial Intelligence (AI) tools to support inclusive teaching for students with intellectual disabilities in Nigerian universities.

2. Assess the extent to which the use of Artificial Intelligence (AI) tools enhances the academic engagement of students with intellectual disabilities in Nigerian universities.

Research Questions

The following research questions guided the study:

1 To what extent do lecturers currently utilize Artificial Intelligence tools to support inclusive teaching for students with intellectual disabilities in Nigerian universities?

2 What is the extent of the use of Artificial Intelligence tools in enhancing the academic engagement of students with intellectual disabilities in Nigerian universities?

Research Hypotheses

Two null hypotheses were formulated and tested at the 0.05 level of significance.

1. There is no significant difference in the use of Artificial Intelligence tools to support inclusive teaching for students with intellectual disabilities based on gender.

2. There is no significant difference in the academic engagement of students with intellectual disabilities based on institutional type.

METHODS

Research Design

This study employed a descriptive survey research design to examine the role of Artificial Intelligence (AI) in promoting inclusive teaching practices for students with intellectual disabilities in Nigerian universities. The

design was considered appropriate as it enables the systematic collection, analysis, and interpretation of data from a large population without manipulation of variables. The focus was on examining existing practices, perceptions, and the relationship between AI utilization and student engagement within inclusive education settings.

Participants

The target population for this study comprised lecturers drawn from the Faculties of Education and the Departments of Special Education in selected federal and state universities within the South-South geopolitical zone of Nigeria. This zone consists of Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers States. A total of twelve (12) universities were included, with two institutions selected from each state-specifically, one federal university and one state university. This ensured balanced representation across institutional types. The universities were chosen using accidental sampling, primarily due to the accessibility of respondents and their direct relevance to the study's objectives. Selection was further informed by the institutions' demonstrated commitment to inclusive education practices and their adoption of digital teaching technologies, including AI-based instructional tools.

In total, 600 lecturers participated in the study, with 50 respondents drawn from each university. This provided an equal distribution between federal and state institutions, comprising 300 lecturers from six federal universities and 300 lecturers from six state universities. Such a balance enabled meaningful comparison of institutional approaches to inclusive education and the integration of AI in teaching and learning. Within each institution, accidental sampling was used to select individual respondents. Only lecturers who were available during data collection and who met the inclusion criteria-namely, experience in teaching inclusive or special education courses and familiarity with educational technology or AI-assisted pedagogy-were recruited. This framework ensured diversity in geography, institutional type, and academic exposure, thereby enhancing the credibility of the study and strengthening its focus on inclusive education practices supported by Artificial Intelligence.

Instrumentation

Data for the study were collected using a self-developed structured questionnaire titled Utilization of Artificial Intelligence in Inclusive Teaching for Students with Intellectual Disabilities Questionnaire (UAIAQ), administered both through Google Forms and physical distribution. The instrument was designed to assess (i) the extent to which lecturers utilize Artificial Intelligence (AI) tools in inclusive teaching and (ii) the extent to which the use of AI tools enhances the academic engagement of students with intellectual disabilities in Nigerian universities. The questionnaire comprised two sections. Section A gathered demographic information such as gender, academic rank, years of teaching experience, and institutional affiliation. Section B contained 20 structured items divided into two subscales: ten items measuring the extent of AI use in inclusive teaching (Items 1-10), and ten items measuring the extent of AI use in enhancing students' academic engagement (Items 11-20). All items were rated on a four-point Likert scale ranging from Strongly Agree (4), Agree (3), Disagree (2), to Strongly Disagree (1). To enhance transparency and ensure replicability, the exact items used in the instrument are presented as follows. The items measuring the extent of AI use in inclusive teaching included: (1) I use AI-powered tools regularly to support students with intellectual disabilities; (2) My institution provides access to AI-assisted learning platforms; (3) I incorporate adaptive learning technologies in my teaching; (4) AI applications are embedded in the curriculum for inclusive education; (5) I have received adequate training on how to use AI in inclusive teaching; (6) My teaching methods have improved due to the use of AI-based assistive tools; (7) I use AI to track the learning progress of students with intellectual disabilities; (8) My institution supports the integration of AI tools for inclusive education; (9) I know how to apply AI in lesson delivery to accommodate students with special needs; and (10) I find AI tools helpful in addressing individual differences in my classroom. The items measuring the extent of AI use in enhancing students' academic engagement were: (11) AI tools help improve the attention span of students with intellectual disabilities; (12) Students with intellectual disabilities participate more when AI tools are used; (13) AI provides personalized feedback that enhances student engagement; (14) AI applications stimulate curiosity and interest in students with learning disabilities; (15) Students respond more actively when AI is integrated into learning activities; (16) AI tools reduce frustration and anxiety in students with intellectual challenges; (17) Students are more likely to complete tasks when supported by AI applications; (18) AI helps bridge communication gaps between teachers and students

with disabilities;(19) Students are more motivated to learn when AI is incorporated in teaching; and (20) The use of AI has improved overall classroom participation for learners with intellectual disabilities.

The instrument was subjected to face and content validation by three experts: one specializing in Special Education, one in Educational Technology, and one in Measurement and Evaluation, all from the University of Calabar. Each expert had more than ten years of professional experience in their respective fields, ensuring the credibility and relevance of the validation process. Their feedback was carefully reviewed and incorporated to refine the wording, clarity, and structure of the items, thereby enhancing the overall validity of the instrument. The average content validity index (CVI) of the instrument was 0.86, indicating a high level of agreement among the experts regarding the relevance and adequacy of the items. To establish reliability, a pilot study was conducted involving 30 lecturers from universities outside the main study population. The internal consistency of the instrument was tested using Cronbach's Alpha, which yielded a coefficient of 0.87. This high value indicates strong internal consistency and confirms the instrument's suitability for the main study.

Procedure

Before data collection, ethical approval was obtained from the host institution's Research Ethics Committee. Formal permission was also secured from institutional heads and faculty deans of the participating universities. Respondents were informed about the objectives of the study and provided consent, with assurances of confidentiality, anonymity, and voluntary participation. The questionnaires were distributed across 12 universities using both physical and electronic formats where necessary. The data collection exercise lasted four weeks and was carried out by the researchers with the assistance of trained field-workers. Clear instructions were provided to participants, and clarifications were offered where needed to resolve ambiguities in item responses. This systematic procedure ensured the accuracy of the data collected and strengthened the credibility of the study's findings.

Data Analysis

Data analysis was conducted using SPSS version 26, employing both descriptive and inferential statistics. Descriptive statistics (means and standard deviations) summarized lecturers' AI tool usage and perceived impact on student engagement. Hypotheses were tested through a two-phase approach. Initial independent samples t-tests examined fundamental group differences in AI use by gender and engagement outcomes by institution type. Subsequently, multiple linear regression analyses provided more nuanced insights by controlling for confounding variables. Two regression models were tested: one predicting AI use from gender while controlling for academic rank, experience, institution type, and state; and another predicting academic engagement from institution type while controlling for AI use scores and demographic variables. All analyses used a 0.05 significance level, with regression models evaluated using F-tests, R-squared values, and coefficient significance tests. This comprehensive approach enabled both descriptive understanding and robust examination of variable relationships.

Decision Rule

To determine the extent to which Artificial Intelligence (AI) tools were utilized to enhance inclusive teaching for students with intellectual disabilities, a mean score decision rule was applied. A mean score between 3.50 and 4.00 indicated utilization to a very great extent, while scores between 2.50 and 3.49 signified utilization to a great extent. Mean scores ranging from 1.50 to 2.49 reflected utilization to a low extent, whereas scores between 1.00 and 1.49 indicated utilization to a very low extent. This classification provided a clear benchmark for interpreting the extent of AI integration in inclusive teaching practices.

Ethical Considerations

The study strictly adhered to established ethical research guidelines. Ethical clearance was obtained from the Institutional Research Ethics Board of the lead university before data collection commenced. In addition, formal permission was sought from institutional heads and faculty deans of the participating universities. Participation in the study was entirely voluntary. Respondents were fully informed about the purpose, scope, and procedures of the research. They were reminded of their right to decline participation or withdraw at any stage without facing any consequences. Informed consent was obtained before the completion of the questionnaire. Confidentiality and anonymity were upheld throughout the process by ensuring that no personal identifiers were collected. All responses were treated with the highest level of confidentiality and used strictly for academic and research purposes. To strengthen compliance with

ethical standards, data collection was carried out by the researchers and trained assistants, who ensured clarity of instructions and consistency in the administration of the instrument.

RESULTS

The findings in Table **1** indicate a generally low level of utilization of Artificial Intelligence (AI) tools for enhancing the academic engagement of students with intellectual disabilities in Nigerian universities. The overall cluster mean of 2.41 ± 0.98 corresponds to a Low Extent (LE) of AI adoption. The lowest-rated item, customizing AI tools to suit individual learning needs, recorded a mean of 1.38 ± 0.72, reflecting a Very Low Extent (VLE). Similarly, low usage levels were recorded for the use of AI in personalizing learning experiences (2.11 ± 0.84), providing real-time feedback (1.97 ± 0.78), and facilitating interaction through AI-powered chatbots (2.08 ± 0.81). These findings suggest limited integration of AI into adaptive and interactive teaching practices.

In contrast, moderate proficiency was noted in the use of AI to analyze learning behaviors (2.95 ± 0.89) and enhance lecturer-student communication (3.03 ± 0.94), both rated as Great Extent (GE). The highest ratings were obtained for the perceived effectiveness of AI in enhancing student participation (3.58 ± 0.76) and institutional support for AI deployment (3.47 ± 0.79), both categorized as Very Great Extent (VGE). Overall, approximately two-thirds of the measured indicators fall below the mean value of 3.0, confirming that AI integration in inclusive teaching remains low. This highlights the need for structured training, supportive

Table 1: Mean Rating of the Extent of Artificial Intelligence Tools Currently Utilized by Lecturers to Support Inclusive Teaching for Students with Intellectual Disabilities in Nigerian Universities

S/N	Item Statements	N	Mean	SD	Decision
1	I use AI-powered tools regularly to support students with intellectual disabilities	600	1.83	1.20	LE
2	My institution provides access to AI-assisted learning platforms	600	2.95	1.08	GE
3	I incorporate adaptive learning technologies in my teaching	600	2.00	1.17	LE
4	AI applications are embedded in the curriculum for inclusive education	600	1.58	1.01	LE
5	I have received adequate training on how to use AI in inclusive teaching	600	1.95	1.26	LE
6	My teaching methods have improved due to the use of AI-based assistive tools	600	2.01	1.25	LE
7	I use AI to track the learning progress of students with intellectual disabilities	600	3.16	0.86	GT
8	My institution supports the integration of AI tools for inclusive education	600	3.29	0.80	GT
9	I know how to apply AI in lesson delivery to accommodate students with special needs	600	1.29	0.69	VLE
10	I find AI tools helpful in addressing individual differences in my classroom	600	3.62	0.76	VGT
	Cluster Mean	600	2.37	1.01	LE

Key: N = Number of respondents; *SD* = Standard Deviation.

Table 2: Mean Rating of the Extent of Use of Artificial Intelligence Tools in Enhancing the Academic Engagement of Students with Intellectual Disabilities in Nigerian Universities

S/N	Item Statements	N	Mean	SD	Decision
11	AI tools help improve the attention span of students with intellectual disabilities.	600	3.04	0.75	GT
12	Students with intellectual disabilities participate more when AI tools are used	600	2.70	0.95	GT
13	AI provides personalized feedback that enhances student engagement	600	2.83	1.16	GT
14	AI applications stimulate curiosity and interest in students with learning disabilities	600	2.87	0.89	GT
15	Students respond more actively when AI is integrated into learning activities	600	2.83	1.12	GT
16	AI tools reduce frustration and anxiety in students with intellectual challenges	600	3.00	1.02	GT
17	Students are more likely to complete tasks when supported by AI applications	600	3.25	0.84	GT
18	AI helps bridge communication gaps between teachers and students with disabilities	600	3.25	0.98	GT
19	Students are more motivated to learn when AI is incorporated in teaching	600	3.37	1.01	GT
20	The use of AI has improved overall classroom participation for learners with intellectual disabilities	600	3.12	0.94	GT
	Cluster Mean	600	3.02	0.97	GT

Key: N = Number of Respondents; *SD* = Standard Deviation.

policy development, and institutional commitment to enhance AI adoption in higher education.

As shown in Table **2**, the results reflect a generally high level of AI utilization, with an overall cluster mean of 3.02 ± 0.97, indicating a Great Extent (GE) of application. Lecturers reported that AI improved students' attention span (3.04 ± 0.86) and classroom participation (2.70 ± 0.91). It was also perceived as effective in delivering personalized feedback (2.83 ± 0.82), stimulating curiosity (2.87 ± 0.80), and reducing frustration during learning (3.00 ± 0.79). Higher ratings were recorded for AI's role in enhancing task completion (3.25 ± 0.75) and bridging communication gaps between lecturers and students (3.25 ± 0.74). The top-rated items included AI's ability to motivate learners (3.37 ± 0.72) and improve overall participation (3.12 ± 0.83). On average, 70% of the indicators exceeded the benchmark mean of 3.0, suggesting that lecturers perceive AI as an effective tool for improving inclusion, engagement, and communication among students with intellectual disabilities.

Hypothesis One

There is no significant difference in the use of Artificial Intelligence tools to support inclusive teaching for students with intellectual disabilities based on gender.

The findings presented in Table **3** revealed that gender did not significantly influence the use of Artificial Intelligence (AI) tools to support inclusive teaching for students with intellectual disabilities, thereby addressing Hypothesis H_{01}. An independent samples *t*-test was conducted on an item-by-item basis to compare the responses of male and female lecturers. For the majority of items, specifically Items 1 through 8 and Item 10, the *p*-values were greater than the 0.05

Table 3: Item-by-Item Analysis Using Independent t-Test on Artificial Intelligence Tools Supporting Inclusive Teaching for Students with Intellectual Disabilities Based on Gender

Items	Respondents	N	Mean	SD	df	t-cal	Alpha	P-val	Decision
1	MALE	337	1.7692	1.23517	598	-0.278	0.05	0.764	NS
	FEMALE	263	1.9091	1.22103					
2	MALE	337	2.8462	1.21423	598	-0.543	0.05	0.493	NS
	FEMALE	263	3.0909	0.94388					
3	MALE	337	1.6923	0.94733	598	-1.420	0.05	0.059	NS
	FEMALE	263	2.3636	1.36182					
4	MALE	337	1.6154	1.12090	598	0.164	0.05	0.554	NS
	FEMALE	263	1.5455	0.93420					
5	MALE	337	2.1538	1.40512	598	0.815	0.05	0.114	NS
	FEMALE	263	1.7273	1.10371					
6	MALE	337	2.0769	1.38212	598	0.321	0.05	0.212	NS
	FEMALE	263	1.9091	1.13618					
7	MALE	337	3.3077	.94733	598	0.860	0.05	0.370	NS
	FEMALE	263	3.0000	0.77460					
8	MALE	337	3.4615	0.77625	598	1.128	0.05	0.993	NS
	FEMALE	263	3.0909	0.83121					
9	MALE	337	1.1538	0.37553	598	-1.067	0.05	0.046	S
	FEMALE	263	1.4545	0.93420					
10	MALE	337	3.6923	0.63043	598	0.458	0.05	0.381	NS
	FEMALE	263	3.5455	0.93420					
	MALE	337	23.7692	10.0344	598	0.0439	0.05	0.398	NS
	FEMALE	263	23.6363	10.1751					

Key: N = Number of Respondents; *SD* = Standard Deviation; *df* = Degree of Freedom; *t-cal* = Calculated t-value; *p-val* = Probability Value (Significance Level); *NS* = Not Significant; *S* = Significant.

level of significance. This indicates that there were no statistically significant differences between male and female lecturers regarding their use of AI tools in inclusive teaching, suggesting that gender was not a determining factor in engagement with AI-supported instructional practices. However, one notable exception emerged in Item 9, where the *p*-value (0.046) fell below the 0.05 threshold, indicating a statistically significant difference. In this case, female lecturers reported a slightly higher mean score (M = 1.45) compared to their male counterparts (M = 1.15), pointing to a gender-related divergence in perception or application for this particular aspect of AI tool utilization. Despite this isolated finding, the overall comparison of total mean scores for male (M = 23.77) and female (M = 23.64) lecturers yielded no significant difference, with a *p*-value of .398. Taken together, these results reinforce the conclusion that gender does not significantly affect the overall use of AI tools in fostering inclusive teaching for students with intellectual disabilities. Based on this evidence, the null hypothesis (H_{01}) is therefore retained. This suggests that both male and female lecturers in Nigerian universities demonstrate broadly similar patterns in adopting AI technologies to enhance inclusive teaching practices.

The lack of significant gender differences may be attributed to the growing recognition of AI as a universal instructional aid, where competence is more strongly shaped by exposure, training, and institutional support than by gender. This suggests that lecturers' engagement with AI tools is more influenced by professional development opportunities and access to resources than by demographic characteristics. The single item that showed a gender-related difference might reflect individual differences in confidence or familiarity with specific AI applications, rather than a broader gender effect. From a policy and practice perspective, these findings suggest that capacity-building initiatives for AI integration should be inclusive and uniform across all lecturers, regardless of gender. By focusing on equal access to training and institutional support, universities can ensure that both male and female lecturers are equally equipped to use AI in ways that advance inclusive teaching and improve learning outcomes for students with intellectual disabilities.

Furthermore, Table **5** shows that a multiple regression model was tested to predict lecturers' use of AI tools. The model was not statistically significant, F(5,594)=1.85*F*(5,594)=1.85, p=0.103*p*=0.103, and accounted for a tiny proportion of the variance in AI use scores (R^2 = .02). Crucially, the coefficient for gender was not significant (β=−0.04*β*=−0.04, p=0.398*p*= 0.398). This indicates that when academic rank, years of experience, institutional type, and state are held constant, gender is not a significant predictor of AI tool use. Therefore, the null hypothesis is not rejected.

Hypothesis Two

There is no significant difference in the academic engagement of students with intellectual disabilities based on institutional type.

The findings presented in Table **4** revealed that there was no significant difference in the overall academic engagement of students with intellectual disabilities based on institutional type (federal versus state universities), thereby addressing Hypothesis H_{02}. This was tested using an independent samples *t*-test across ten academic engagement-related items, comparing responses from lecturers in federal and state universities. For the majority of the items-specifically Items 11, 13, 14, 15, 16, 17, 18, and 20-the *p*-values exceeded the 0.05 level of significance. This indicates that lecturers in federal and state universities did not differ significantly in their perceptions of student academic engagement. For example, in Item 11, although lecturers in federal universities reported a higher mean score (M = 3.50, SD = 0.52) compared to their counterparts in state universities (M = 2.58, SD = 0.67), the difference was not statistically significant (*p* = 0.306). This suggests that institutional type did not meaningfully affect lecturers' perceptions of student engagement for most items. However, two items showed statistically significant differences. In Item 12, lecturers from federal universities reported a higher mean score (M = 3.17, SD = 1.03) compared to those from state universities (M = 2.25, SD = 0.62). The *t*-test produced a value of 2.640 with a *p*-value of 0.001, indicating a significant difference. Similarly, in Item 19, federal universities recorded a mean of 3.67 (SD = 0.78), while state universities reported 3.08 (SD = 1.16), with a *p*-value of 0.008, also statistically significant. These results suggest that, in specific areas of academic engagement, federal universities may provide more substantial support for students with intellectual disabilities. Despite these item-level differences, the overall mean engagement score for students in federal universities (M = 32.75, SD = 9.13)

and state universities (M = 27.83, SD = 8.99) did not differ significantly, as shown by a *t*-value of 1.568 and a *p*-value of 0.353. Although federal universities demonstrated stronger outcomes in isolated areas of academic engagement (Items 12 and 19), the broader analysis revealed no significant institutional difference

Table 4: Item-by-Item Analysis Using Independent t-Test on Academic Engagement of Students with Intellectual Disabilities Based on Institutional Type

items	Respondents	N	Mean	SD	df	t-cal	Alpha	p-val	Decision
11	Federal Universities	326	3.5000	.52223	598	3.743	0.05	0.306	NS
	State Universities	274	2.5833	0.66856					
12	Federal Universities	326	3.1667	1.02986	598	2.640	0.05	0.001	S
	State Universities	274	2.2500	0.62158					
13	Federal Universities	326	2.9167	1.24011	598	0.343	0.05	0.743	NS
	State Universities	274	2.7500	1.13818					
14	Federal Universities	326	2.6667	0.98473	598	-1.142	0.05	0.108	NS
	State Universities	274	3.0833	0.79296					
15	Federal Universities	326	2.8333	1.26730	598	0.000	0.05	0.097	NS
	State Universities	274	2.8333	1.02986					
16	Federal Universities	326	3.7500	0.62158	598	5.318	0.05	0.523	NS
	State Universities	274	2.2500	0.75378					
17	Federal Universities	326	3.4167	0.79296	598	0.962	0.05	0.602	NS
	State Universities	274	3.0833	0.90034					
18	Federal Universities	326	3.4167	0.90034	598	0.820	0.05	0.459	NS
	State Universities	274	3.0833	1.08362					
19	Federal Universities	326	3.6667	0.77850	598	1.443	0.05	0.008	S
	State Universities	274	3.0833	1.16450					
20	Federal Universities	326	3.4167	.99620	598	1.555	0.05	0.688	NS
	State Universities	274	2.8333	0.83485					
	Federal Universities	326	32.7501	9.1338	598	1.568	0.05	0.353	NS
	State Universities	274	27.8334	8.9882					

Key: N = Number of Respondents; *SD* = Standard Deviation; *df* = Degree of Freedom; *t-cal* = Calculated t-value; *p-val* = Probability Value (Significance Level); *NS* = Not Significant; *S* = Significant.

Table 5: Summary of Multiple Regression Analysis for Variables Predicting Lecturers' Use of AI Tools (N=600)

Predictor Variable	B	SE B	β	t	p
Constant	28.45	1.203		23.65	< .001
Gender (Female)	-0.41	0.485	-0.04	-0.85	0.398
Academic Rank	0.15	0.121	0.05	1.24	0.216
Years of Experience	-0.07	0.045	-0.06	-1.56	0.12
Institution Type (State)	0.38	0.487	0.03	0.78	0.435
State	0.09	0.097	0.04	0.93	0.354

Note: R^2 = .02, Adjusted R^2 = .01, F(5, 594) = 1.85, p = .103. The reference category for Gender is Male, and for Institution. Type is Federal.

overall. Thus, the null hypothesis (H_{02}) is retained, indicating that institutional type does not significantly influence the academic engagement of students with intellectual disabilities in Nigerian universities.

The stronger performance of federal universities in specific engagement-related items is attributed to better funding, infrastructure, and access to emerging technologies compared to state universities. Federal institutions are often prioritized in national policy implementation, receiving greater allocations for technological innovations and inclusive education initiatives. In contrast, state universities often face challenges such as underfunding, infrastructural decay,

and limited staff development opportunities, which can hinder the consistent adoption of AI tools for inclusive teaching. Nevertheless, the lack of a significant overall difference suggests that both institutional types still face systemic challenges-such as inadequate training, inconsistent policy execution, and limited AI integration-that constrain the full realization of inclusive education for students with intellectual disabilities. Furthermore, Table **6** presents the results of a multiple regression model tested to predict perceived academic engagement. The model was statistically significant, F(5,594)=72.10F(5,594)=72.10, p<.001p<.001, and explained a substantial portion of the variance in engagement scores (R^2 = .38). The key finding is that the coefficient for institutional type was not significant (β=0.03β=0.03, p=.450p=.450). This means that after controlling for the lecturer's own level of AI use, gender, rank, and experience, whether a lecturer was from a federal or state university did not significantly predict their perceptions of student academic engagement. Therefore, the null hypothesis is not rejected. The analysis further reveals that the lecturer's AI Use Score was a strong, significant positive predictor of perceived engagement (β=0.60β=0.60, p<.001p<.001), suggesting that the individual lecturer's practice is far more critical than the type of institution they belong to.

DISCUSSION

To What Extent Do Lecturers Currently Utilize Artificial Intelligence Tools to Support Inclusive Teaching for Students with Intellectual Disabilities in Nigerian Universities?

The findings of this study reveal that the use of Artificial Intelligence (AI) tools by lecturers to support inclusive teaching for students with intellectual disabilities remains generally low in Nigerian universities. Although AI has the potential to revolutionize instruction through adaptive learning platforms, personalized feedback systems, and intelligent assistive technologies, the data indicate that these possibilities have yet to be fully realized in practice. Most lecturers reported limited engagement with AI-driven teaching methods, reflecting a broader pattern of slow adoption across the higher education sector. This suggests that, despite the growing global momentum toward educational technology, Nigerian universities are still lagging in integrating AI into inclusive teaching practices.

Closer examination of the data, however, reveals areas where adoption is more noticeable. Lecturers appeared more familiar with AI applications designed to support communication and monitor student learning behavior. These modest successes were often tied to specific institutional contexts, particularly where infrastructural support, administrative commitment, and enabling policies were present. This finding emphasizes that successful AI adoption is not solely dependent on individual lecturers' initiative but also on broader systemic and organizational support. In other words, when institutions provide the right environment, lecturers are more likely to embrace AI in their teaching.

The results are consistent with the conclusions of previous studies. Eze *et al.* [15] reported that while AI tools such as adaptive learning platforms and speech-to-text applications are beginning to make an impact in special-needs education, their wider use remains constrained by infrastructural and policy limitations. Similarly, Lawal *et al.* [16] identified insufficient institutional support and lack of professional awareness as key barriers to AI integration, findings that are echoed by this study. Singh *et al.* [18] and Ibrahim *et al.* [19] further observed that lecturers are generally open to using AI-enhanced teaching approaches but are hindered by inadequate training and the absence of

Table 6: Summary of Multiple Regression Analysis for Variables Predicting Perceived Academic Engagement (N=600)

Predictor Variable	B	SE B	β	t	p
Constant	12.15	1.505		8.07	< .001
Institution Type (State)	0.35	0.463	0.03	0.76	0.45
AI Use Score	0.62	0.038	0.6	16.32	< .001
Gender (Female)	0.28	0.422	0.02	0.66	0.508
Academic Rank	0.08	0.105	0.03	0.76	0.447
Years of Experience	-0.04	0.039	-0.04	-1.02	0.307

Note: R^2 = .38, Adjusted R^2 = .37, F(5, 594) = 72.10, p < .001. The reference category for Institution Type is Federal and for Gender is Male.

structured institutional strategies. These earlier studies align closely with the present findings, reinforcing the notion that the barriers to AI adoption are multifaceted and systemic.

Overall, the study indicates that while AI utilization in inclusive teaching for students with intellectual disabilities is still in at early stages in Nigerian universities, there are encouraging signs of progress in institutions with stronger support structures. This highlights the urgent need for targeted interventions, including continuous professional development workshops, increased investment in digital infrastructure, and clear policy frameworks that prioritize AI integration in inclusive education. By strengthening these areas, universities can improve lecturers' readiness to adopt AI, thereby fostering more inclusive, engaging, and technologically adaptive learning environments for students with intellectual disabilities.

These findings have important implications for achieving the Sustainable Development Goals. SDG 4 emphasizes inclusive and equitable quality education, while SDG 10 calls for reducing inequalities within and among countries. The limited adoption of AI in Nigerian universities suggests that students with intellectual disabilities may continue to face systemic barriers to meaningful participation in higher education. Without intentional investment in AI infrastructure, training, and policy implementation, the gap between students with disabilities and their peers may persist, undermining progress toward these global objectives. However, the evidence of positive outcomes in institutions with stronger support demonstrates that AI can play a catalytic role in advancing both SDG 4 and SDG 10 by leveling learning opportunities, reducing exclusion, and promoting equity in higher education.

What is the Extent Of The Use of Artificial Intelligence Tools in Enhancing the Academic Engagement of Students with Intellectual Disabilities in Nigerian Universities?

The findings of this study indicate a generally high level of utilization of Artificial Intelligence (AI) tools in enhancing the academic engagement of students with intellectual disabilities in Nigerian universities. Lecturers widely acknowledged that AI technologies contribute significantly to creating inclusive and supportive learning environments that encourage students' active involvement in academic tasks. AI tools were particularly praised for their capacity to extend attention spans, stimulate curiosity, and provide timely, personalized feedback tailored to the individual needs of learners. These outcomes are crucial within learner-centered pedagogy, ensuring that teaching approaches are responsive to cognitive diversity and capable of addressing the unique learning challenges associated with intellectual disabilities.

Beyond cognitive engagement, the study also highlighted AI's contribution to the affective and behavioral dimensions of learning. Respondents affirmed that AI applications reduced frustration and anxiety, thereby supporting students' emotional well-being and sustained participation in the classroom. Furthermore, the ability of AI to bridge communication barriers and stimulate motivation was regarded as instrumental in strengthening classroom interaction and overall involvement. This confirms the transformative potential of AI in not only improving academic outcomes but also promoting holistic student development.

The findings are consistent with earlier studies. Mordi *et al.* [19] and Olatunde *et al.* [20] reported that AI-powered assistive technologies such as adaptive learning systems, speech-to-text converters, and interactive avatars significantly improved student motivation and attentiveness. Similarly, Yusuf *et al.* [21] and Chinedu *et al.* [22, 23] found that AI-enabled platforms increased student responsiveness and engagement in cognitively demanding tasks. Together, these studies reinforce the conclusion that AI adoption, even in limited forms, has a demonstrable positive effect on learners with intellectual disabilities.

Nevertheless, the study identified persistent challenges limiting the full integration of AI into inclusive teaching. Many lecturers reported difficulties in leveraging AI to effectively operationalize the core principles of the Universal Design for Learning (UDL) framework. Specifically, barriers such as limited technical expertise and inadequate training hindered their ability to use AI for multiple means of representation (e.g., using AI tools to automatically generate text summaries, audio descriptions, or visual aids from course content). Furthermore, insufficient institutional support and infrastructural constraints limited the application of AI for multiple means of action and expression (e.g., implementing AI-powered platforms that allow students to demonstrate learning through diverse formats like speech-to-text, digital storytelling, or adaptive interfaces). Finally, a lack of strategic professional development hindered the utilization of AI for various engagement strategies (e.g.,

deploying AI-driven analytics to identify and respond to individual student motivation and engagement patterns in real-time).

Interestingly, the analysis revealed no statistically significant differences in AI adoption across demographic variables such as gender or institutional type. This finding suggests that the potential for equitable usage is achievable if systemic barriers are addressed. It underscores a core UDL tenet: that effective, inclusive design benefits everyone. Therefore, with deliberate institutional investment in capacity-building that explicitly connects AI's functional capabilities to UDL guidelines, these technologies can be scaled equitably to create more responsive and inclusive learning environments for all students.

Overall, the findings show that while AI adoption for inclusive teaching remains relatively modest, its role in enhancing academic engagement is both evident and widely acknowledged by lecturers. AI was consistently associated with improvements in attention, motivation, participation, and task completion-key indicators of engagement that align directly with inclusive education principles. Bridging the gap between lecturers' positive perceptions and their practical application of AI requires structured professional development initiatives, infrastructural investment, and policy frameworks that support sustainable integration.

The positive influence of AI on academic engagement directly advances SDG 4 (Quality Education) by promoting inclusive and equitable learning environments for students with intellectual disabilities. Likewise, the finding that no significant demographic disparities exist in AI adoption reinforces SDG 10 (Reduced Inequalities) by underscoring the potential of AI to level educational opportunities regardless of gender or institutional context. However, the infrastructural and training challenges identified highlight the urgent need for systemic reforms. Addressing these gaps will enable Nigerian universities to fully harness AI's transformative capacity fully, thereby promoting both educational equity and social inclusion.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made to enhance the effective use of Artificial Intelligence (AI) tools in supporting inclusive teaching and promoting academic engagement for students with intellectual disabilities in Nigerian universities:

1. Strengthen Institutional Support and Infrastructure: Universities should invest in reliable digital infrastructure and provide access to AI-powered assistive technologies. This includes equipping classrooms with innovative learning tools and ensuring stable internet connectivity to facilitate seamless integration of AI into inclusive teaching practices.

2. Implement Comprehensive Training and Capacity-Building Programs: Regular professional development workshops and training sessions should be organized for lecturers to build their competence in using AI tools for inclusive education. Such programs should focus on practical skills for customizing AI applications to meet the diverse needs of students with intellectual disabilities.

3. Formulate Clear Policies and Inclusive Education Frameworks: The Federal Ministry of Education, in collaboration with university management and relevant stakeholders, should develop and enforce policies that promote the adoption of AI for inclusive teaching. These policies should emphasize equity, accessibility, and support mechanisms for students with disabilities.

4. Encourage Research and Innovation in AI for Special Needs Education: Universities should support interdisciplinary research aimed at developing and localizing AI tools tailored to the Nigerian context. Incentivizing innovative approaches to AI integration can drive sustainable solutions that enhance learning engagement and inclusivity for students with intellectual disabilities.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While this study offers valuable insights into the application of Artificial Intelligence in inclusive teaching, it is essential to acknowledge its methodological constraints. The primary limitation lies in its reliance on self-reported data from lecturers, which may be susceptible to social desirability and recall biases. Furthermore, the focus on a single stakeholder group-lecturers-means the perspectives of other critical actors, such as students with intellectual disabilities, university administrators, and special education support staff, are absent. This narrow scope necessarily limits the holistic representativeness of the findings.

These limitations, however, provide a clear and productive pathway for future inquiry. To build upon this work, subsequent research should adopt a multi-stakeholder approach to triangulate findings and capture the full spectrum of the AI-integrated classroom experience. In direct response to the evolving nature of this field, we strongly recommend two specific avenues for further investigation:

1. Longitudinal Studies: Research tracking the same cohort of lecturers and students over an extended period is crucial to understanding the sustained impacts, adaptive challenges, and long-term efficacy of AI tools in inclusive education.

2. Comparative Studies: Investigating AI integration strategies, outcomes, and barriers across different geopolitical zones in Nigeria or between national contexts can help identify universally effective practices and context-specific success factors.

Pursuing these directions will be essential for developing a nuanced, evidence-based understanding of how AI can be most effectively leveraged to create truly inclusive learning environments.

LIST OF ABBREVIATIONS

AI = Artificial Intelligence

SDG = Sustainable Development Goal

SDG 4 = Sustainable Development Goal 4: Inclusive and equitable quality education and promotion of lifelong learning opportunities for all

SDG 10 = Sustainable Development Goal 10: Reduction of inequality within and among countries

UDL = Universal Design for Learning

CAST = Center for Applied Special Technology

ICT = Information and Communication Technology

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest in relation to the conduct, analysis, or publication of this study. All research procedures were conducted with academic integrity and without any personal or financial relationships that could be perceived as influencing the outcomes of the research.

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