INFLUENCE OF ARTIFICIAL INTELLIGENCE- DRIVEN EDUCATIONAL TOOLS ON INCLUSIVE PEDAGOGICAL PRACTICES AND LEARNING OUTCOMES AMONG DIVERSE LEARNERS IN LAGOS STATE TECHNICAL COLLEGES, NIGERIA.

Abstract

The integration of AI into education has emerged as a transformative innovation capable of addressing long-standing challenges in inclusive education, particularly in contexts characterized by learner diversity and resource constraints. This study examines the effect of Artificial Intelligence (AI) tool integration on inclusive pedagogical practices and learning outcomes among diverse learners in technical colleges in Lagos State, Nigeria. The population of the study comprised all students in selected technical colleges in Lagos State Technical Colleges. A sample size of 320 participants **(**technical college students) was selected usingmultistage sampling technique method to ensure statistical power and generalizability. Data were collected using researcher-developed Structured Questionnaire titled: Artificial Intelligence-Driven Educational Tools, Inclusive Pedagogical Practices and Learning Outcomes Questionnaire (AIDET-IPPLOQ), AI-Integrated Instructional Module (Treatment Tool), and Achievement Test**.** The validity of the instruments was established through multiple approaches: Content Validity; Construct Validity and Face Validity. Using Cronbach's alpha coefficientreliability of 0.70 was established. Data were analyzed using descriptive statistics and inferential analysis to test hypotheses at a 0.05 level of significance. The findings indicate that AI integration significantly improves inclusive pedagogical practices by enabling differentiated instruction, increasing learner engagement, and enhancing teacher responsiveness. Additionally, students exposed to AI-supported instruction demonstrated higher academic performance, improved technical skills, and better retention rates compared to those taught using traditional methods (Salas-Pilco et al., 2022; Li et al., 2025).Despite these benefits, challenges such as inadequate infrastructure, digital divide, ethical concerns, and lack of professional development for teachers persist (Pagliara et al., 2024). The study concludes that AI holds substantial promise for advancing inclusive technical education in Lagos State, provided that strategic investments are made in infrastructure, teacher training, and policy development. The study recommends the adoption of AI-focused capacity-building programs, increased funding for digital resources, and the development of context-specific AI solutions tailored to technical education environments.

Keywords: Artificial Intelligence, inclusive pedagogical, learning outcomes, Lagos State, technical colleges.

INTRODUCTION

Education remains a fundamental driver of national development and social transformation, particularly in an era characterized by rapid technological advancement and increasing demand for equitable learning opportunities. Contemporary educational systems are increasingly expected not only to transmit knowledge but also to respond to learner diversity through

innovative instructional approaches that enhance participation, engagement, and achievement. Within this transformation agenda, educational technologies have emerged as critical enablers of inclusive and quality education by supporting learner-centred instructional practices, reducing barriers to participation, and improving learning outcomes across different educational contexts (Adenubi et al., 2025).

Among emerging educational innovations, Artificial Intelligence (AI) has attracted considerable attention due to its capacity to transform teaching and learning processes. Artificial Intelligence refers to computational systems capable of performing tasks that ordinarily require human intelligence, including learning, reasoning, prediction, adaptation, and decision-making (Russell & Norvig, 2021). In educational settings, AI extends beyond automation to include intelligent instructional support systems designed to personalize learning experiences, facilitate adaptive teaching, and provide data-driven feedback for instructional improvement (Holmes et al., 2022). The increasing application of AI in education reflects a broader movement toward more responsive and inclusive pedagogical systems capable of accommodating differences in learners' abilities, backgrounds, interests, and educational needs.

AI-driven educational tools encompass a broad range of digital technologies such as adaptive learning platforms, intelligent tutoring systems, automated assessment applications, virtual simulations, predictive analytics systems, assistive technologies, and personalized feedback mechanisms (Luckin et al., 2016; Holmes et al., 2019). These technologies are increasingly recognized for their ability to facilitate individualized learning pathways by adjusting instructional content, delivery pace, assessment methods, and learning support based on learners' characteristics and real-time performance. Such adaptive capabilities make AI particularly relevant to inclusive pedagogical practice, where the objective is to ensure meaningful participation and equitable learning opportunities for all students.

Inclusive pedagogical practice is founded on the principle that diversity should be viewed as an educational asset rather than a limitation. Inclusive pedagogy seeks to create learning environments that accommodate differences among learners and provide equitable access to educational opportunities regardless of ability, socio-economic status, language, gender, or learning preference (Ainscow, 2020). Rather than designing separate instructional approaches for different categories of learners, inclusive pedagogy promotes flexible teaching methods that support engagement, participation, collaboration, and achievement for every learner within shared educational settings (Florian & Black-Hawkins, 2011). The philosophy aligns strongly with global education priorities, particularly Sustainable Development Goal 4, which advocates inclusive and equitable quality education for all (UNESCO, 2021).

Within Technical and Vocational Education and Training (TVET), inclusive pedagogical practice assumes even greater significance because of the practical, competency-based nature of technical instruction. Technical colleges occupy an important position in Nigeria's educational system by preparing learners with occupational competencies, employability skills, entrepreneurial capabilities, and technological literacy necessary for workforce participation and national economic growth. UNESCO (2015) describes TVET as educational provision that equips learners with practical knowledge, technical competence, and occupational skills across various sectors of production and services. In Lagos State, technical colleges continue to play a strategic role in preparing young people for industrial participation and technological advancement.

Despite the importance of technical education, instructional practices within many technical colleges continue to face challenges in meeting the needs of increasingly diverse learner populations. Students enrolled in technical colleges often differ in academic readiness, learning pace, socio-economic background, language exposure, and learning support requirements. Conventional teacher-centred instructional approaches frequently provide limited opportunities for differentiated learning experiences and may unintentionally exclude learners who require alternative instructional pathways or additional academic support (Samuel, 2021; Adeleye et al., 2024).

The integration of AI-driven educational tools offers a promising pathway for addressing these instructional limitations. Through intelligent adaptation and continuous learner monitoring, AI technologies can support differentiated instruction, promote accessibility, and facilitate inclusive teaching practices. Adaptive learning systems can modify content difficulty and learning sequences according to students' progress, while intelligent tutoring systems provide individualized academic support and immediate feedback (Zawacki-Richter et al., 2021). Similarly, assistive AI technologies—including speech-to-text applications, text-to-speech systems, automated captioning, and accessibility-enhancing interfaces—can reduce barriers to participation among learners with varying educational needs (Almalki et al., 2021).

Beyond promoting inclusion, AI-driven educational tools have been associated with improved learning outcomes. Learning outcomes represent measurable changes in learners' knowledge, skills, attitudes, competencies, and academic performance resulting from instructional experiences. Existing studies indicate that AI-supported learning environments can enhance student engagement, strengthen conceptual understanding, improve academic achievement, increase motivation, and facilitate independent learning through continuous formative assessment and personalized instructional support (Luckin et al., 2022; Chen et al., 2023). In technical education settings specifically, AI technologies may improve practical skill acquisition through simulation-based learning, real-time performance analytics, and interactive instructional experiences.

Although the global educational landscape demonstrates increasing integration of AI technologies, adoption across developing educational contexts remains uneven. In Nigeria, infrastructural inadequacies, insufficient digital facilities, limited teacher preparedness, weak institutional readiness, and inadequate policy implementation continue to constrain meaningful integration of AI into classroom practices (Adedoyin & Soykan, 2020; Adeleye et al., 2024). These limitations are particularly relevant within public technical colleges where resource constraints may reduce opportunities to implement emerging technologies for inclusive teaching and learning.

Lagos State has demonstrated considerable interest in educational modernization and digital innovation; however, empirical evidence regarding the extent to which AI-driven educational tools influence inclusive pedagogical practices and learning outcomes within technical colleges remains limited. Existing studies in Nigeria have largely concentrated on general technology adoption, e-learning implementation, and digital literacy, with comparatively little attention given to the intersection of AI, inclusive pedagogy, and learner outcomes within technical and vocational education contexts. Furthermore, few studies have explored how AI technologies can respond to learner diversity within technical colleges and contribute to equitable participation and improved educational outcomes.

This gap in contextual and empirical evidence creates the need for systematic investigation into the educational value of AI-driven technologies within technical education settings. Therefore, this study investigates the influence of Artificial Intelligence-driven educational tools on inclusive pedagogical practices and learning outcomes among diverse learners in Lagos State Technical Colleges, Nigeria. The study is expected to contribute empirical evidence that will guide educational policy, strengthen instructional innovation, support inclusive teaching practices, and inform strategic integration of AI technologies within technical education

LITERATURE REVIEW

Conceptual Review

Concept of Artificial Intelligence-Driven Educational Tools

The integration of Artificial Intelligence (AI) into education has emerged as one of the most influential developments shaping contemporary teaching and learning practices. The growing demand for responsive, equitable, and learner-centred education has accelerated interest in AI technologies as instruments for improving educational delivery and outcomes. Artificial Intelligence refers to computational systems capable of performing tasks traditionally associated with human intelligence, including learning, reasoning, problem-solving, decision-making, prediction, and adaptation (Russell & Norvig, 2021).

Within educational contexts, AI extends beyond automation and encompasses intelligent educational systems that support instruction, assessment, learner engagement, and personalized learning experiences. AI-driven educational tools include adaptive learning systems, intelligent tutoring systems, automated assessment platforms, predictive learning analytics, virtual laboratories, educational chatbots, recommendation systems, and accessibility technologies (Holmes et al., 2022; Zawacki-Richter et al., 2021).

Educational scholars increasingly recognize that AI technologies can transform instructional delivery by generating data-informed insights into learner performance and enabling differentiated teaching approaches. According to Chen et al. (2023), AI facilitates educational personalization by continuously analysing learner behaviour and dynamically adapting instructional pathways to improve learning experiences and educational outcomes.

Within Technical and Vocational Education and Training (TVET), AI-driven tools are particularly valuable because technical education requires practical engagement, competency acquisition, and individualized instructional support. AI-powered simulations, intelligent practice environments, and adaptive instructional systems provide opportunities for learners to acquire technical competencies through flexible and interactive experiences (Adeleye et al., 2024).

Concept of Inclusive Pedagogical Practices

Inclusive pedagogy represents an educational approach designed to accommodate learner diversity and ensure equitable access to meaningful learning opportunities. Inclusive pedagogical practice recognizes that learners differ in terms of abilities, experiences, language, socio-economic background, learning preferences, and educational readiness, and therefore require flexible instructional approaches that promote participation and achievement (Ainscow, 2020).

Rather than viewing diversity as a challenge, inclusive pedagogy positions learner variation as a normal feature of educational environments. Florian and Black-Hawkins (2011) argued that inclusive pedagogy shifts instructional practice from deficit-based teaching to responsive teaching that supports all learners collectively.

In technical colleges, inclusive pedagogy becomes especially important because learners often possess varied academic preparation, practical exposure, and learning capacities. Therefore, instructional systems must support both academic inclusion and competency development.

AI-driven educational tools align strongly with inclusive pedagogy because they enable personalized instruction, immediate feedback, adaptive support, and differentiated learning experiences that accommodate diverse educational needs (Holmes et al., 2022).

Concept of Learning Outcomes among Diverse Learners

Learning outcomes refer to measurable changes in learners' knowledge, competencies, practical skills, attitudes, engagement, and behavioural performance resulting from educational experiences. Educational literature commonly categorizes learning outcomes into three domains: Cognitive outcomes; Psychomotor outcomes; and Affective outcomes.

According to Luckin et al. (2022), AI-supported learning environments improve learning outcomes by enabling continuous assessment, personalized feedback, and adaptive instructional support. Within technical colleges, learning outcomes extend beyond academic achievement to include workforce readiness, employability skills, technical competence, and problem-solving ability.

Conceptual Framework Diagram (Visual Representation)

A conceptual framework is a structured model showing how variables relate and influence each other in a study.

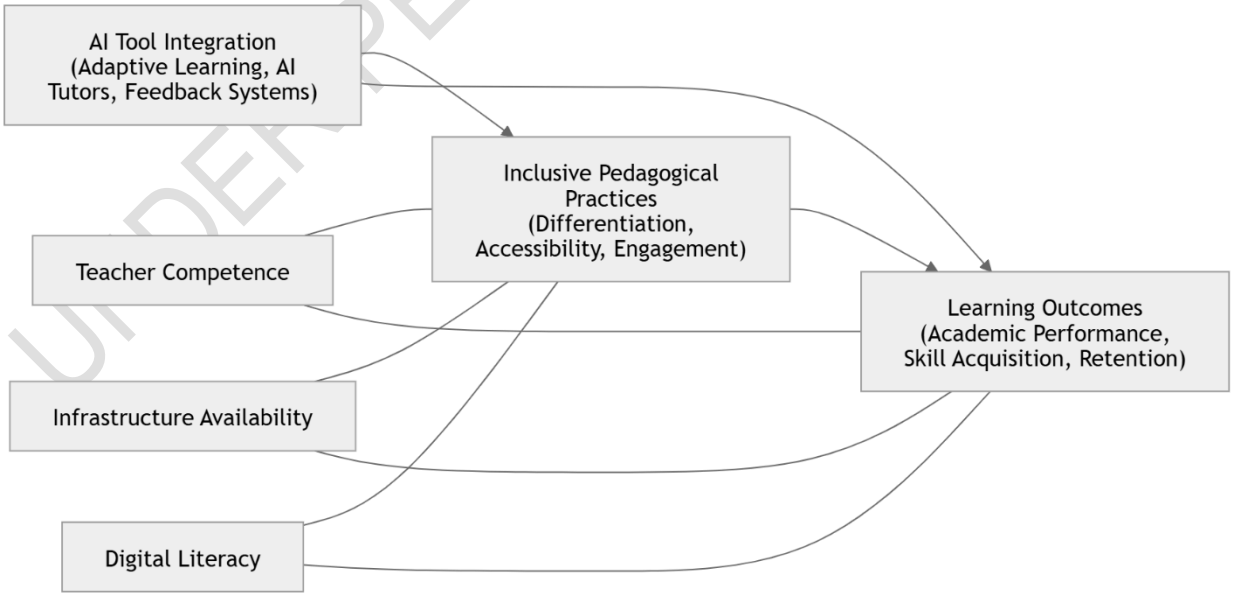

Diagram Explanation (Interpretation)

- Independent Variable (IV): AI Tool Integration
- Mediator: Inclusive Pedagogical Practices
- Dependent Variable (DV): Learning Outcomes
- Moderators: Teacher competence, infrastructure, digital literacy

This model aligns with empirical findings that AI improves learning outcomes indirectly through enhanced teaching practices while contextual factors influence effectiveness (Chen et al., 2023; Holmes et al., 2022). Also, Recent studies confirm that AI improves inclusive practices and learning outcomes when supported by enabling conditions such as teacher readiness and infrastructure (Adigun et al., 2025)

The framework assumes that increased utilization of AI educational tools strengthens inclusive pedagogical practices, which subsequently improve learning outcomes among diverse learners.

Theoretical Framework

Constructivist Learning Theory

This study is anchored first on Constructivist Learning Theory developed by Piaget (1970) and expanded by Vygotsky (1978).

Constructivism proposes that learners actively construct knowledge through interaction with experiences and social environments rather than passively receiving information. Within technical colleges, AI-enabled simulations and personalized learning environments strengthen experiential and competency-based learning.

Universal Design for Learning (UDL)

Universal Design for Learning (UDL), developed by CAST (2021), advocates designing instruction that accommodates learner variability from the outset. AI aligns with UDL principles because intelligent systems provide customized instructional delivery and accessible learning experiences.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis (1989), explains technology adoption through two major determinants: perceived usefulness and perceived ease of use.Within this study, TAM explains teachers' and learners' willingness to adopt AI-driven educational tools in technical colleges.

Empirical Review

Empirical evidence increasingly supports the educational value of AI integration.

Chen et al. (2023) examined AI-supported learning environments and found that AI significantly improved student engagement, individualized learning experiences, and academic performance.

Salas-Pilco et al. (2022) reported that AI-enabled accessibility technologies improved participation among learners with disabilities through adaptive support mechanisms.

Li et al. (2025) found that personalized AI instructional systems positively influenced learner achievement and promoted stronger learning retention.

Holmes et al. (2022) concluded that AI transforms pedagogical practice through adaptive instruction, continuous feedback, and evidence-based decision-making.

Owan et al. (2023) investigated AI integration in educational assessment and reported that AI improved assessment efficiency, enhanced feedback quality, and supported individualized instructional decisions.

Tamayo et al. (2025) observed that AI-based learning environments strengthened learner motivation and enabled targeted academic intervention through adaptive learning pathways.

Within Nigeria, Owolabi et al. (2022) found that exposure to AI technologies improved students' awareness and acceptance of educational innovation, although implementation remained limited.

Adeleye et al. (2024) reported that AI-supported technologies contributed positively to technical education through simulation-based learning and competency development but identified infrastructure and teacher readiness as persistent barriers.

Despite these positive outcomes, several studies highlighted implementation concerns including digital inequality, ethical concerns, infrastructure limitations, algorithmic bias, and insufficient teacher preparedness (Pagliara et al., 2024; Ogunode & Musa, 2023).

Recent studies confirm that AI improves inclusive practices and learning outcomes when supported by enabling conditions such as teacher readiness and infrastructure (Adigun et al., 2025) .

The reviewed literature demonstrates that AI-driven educational tools possess considerable potential to improve inclusive pedagogical practices and enhance learning outcomes through personalized instruction, accessibility support, adaptive assessment, and learner-centred teaching approaches.

Statement of the Problem

The increasing advancement of Artificial Intelligence (AI) technologies has transformed educational systems globally by introducing intelligent instructional approaches capable of supporting personalized learning, improving accessibility, and enhancing educational outcomes. Across different educational contexts, AI-driven educational tools such as adaptive learning platforms, intelligent tutoring systems, automated assessment technologies, virtual simulations, and assistive learning applications are increasingly recognized as mechanisms for strengthening inclusive teaching practices and improving student achievement (Holmes et al., 2022; Chen et al., 2023). These technologies have demonstrated substantial potential for accommodating learner diversity and supporting equitable participation in educational environments. Despite these global advancements, achieving inclusive and effective learning experiences remains a significant challenge within many developing educational systems, including Nigeria. Technical colleges, which are expected to equip learners with practical competencies, employability skills, technological literacy, and workforce readiness, continue to experience challenges associated with instructional delivery, unequal access to learning opportunities, and inadequate responsiveness to learner diversity. Students enrolled in technical colleges often differ in their academic abilities, socio-economic backgrounds, learning pace, prior exposure to technology, and support requirements; however, instructional practices frequently remain dominated by

conventional teacher-centred approaches that offer limited opportunities for differentiated learning and inclusive participation (Samuel, 2021; Adeleye et al., 2024). Inclusive pedagogical practice advocates instructional flexibility that accommodates diverse learner needs and ensures equitable participation in educational processes (Ainscow, 2020). However, implementing inclusive teaching practices in many Nigerian educational institutions has remained difficult due to inadequate digital infrastructure, limited teacher preparedness, insufficient access to educational technologies, and weak institutional readiness for instructional innovation (Adedoyin & Soykan, 2020). These constraints may contribute to disparities in learner engagement, participation, practical skill acquisition, and academic outcomes. Although Lagos State has demonstrated increasing commitment toward educational modernization and technology integration, empirical evidence suggests that the adoption and utilization of AI-driven educational tools within technical colleges remain limited and uneven. Existing studies in Nigeria have concentrated largely on general educational technology adoption, e-learning practices, digital literacy, and technology acceptance, with relatively little attention devoted to understanding how AI-driven educational tools influence inclusive pedagogical practices and learning outcomes among diverse learners within Technical and Vocational Education and Training (TVET) environments. Furthermore, there remains insufficient empirical evidence establishing whether AI-enabled instructional approaches meaningfully contribute to inclusive teaching and improved learning outcomes in Lagos State Technical Colleges. Consequently, the persistent uncertainty regarding the effectiveness of AI-driven educational tools in promoting learner inclusion and enhancing educational performance constitutes a critical knowledge gap. It is against this background that this study investigates the influence of Artificial Intelligence-driven educational tools on inclusive pedagogical practices and learning outcomes among diverse learners in Lagos State Technical Colleges, Nigeria.

Purpose of the Study

The main purpose of this study is to investigate the influence of Artificial Intelligence-driven educational tools on inclusive pedagogical practices and learning outcomes among diverse learners in Lagos State Technical Colleges, Nigeria.

Specifically, the study seeks to:

1. examine the effect of Artificial Intelligence-driven educational tools on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges;
2. determine the effect of Artificial Intelligence-driven educational tools on learning outcomes among diverse learners in Lagos State Technical Colleges.

Research Questions

The following research questions guided the study:

1. What is the effect of Artificial Intelligence-driven educational tools on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges?

2. What is the effect of Artificial Intelligence-driven educational tools on learning outcomes among diverse learners in Lagos State Technical Colleges?

Hypotheses

The following null hypotheses will be tested at 0.05 level of significance:

H_{01} Artificial Intelligence-driven educational tools have no significant effect on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges.

H_{02}: Artificial Intelligence-driven educational tools have no significant effect on learning outcomes among diverse learners in Lagos State Technical Colleges.

Methodology

Research Design

This study adopted a descriptive survey research design of correlationaltype to investigate the influence of Artificial Intelligence-driven educational tools on inclusive pedagogical practices and learning outcomes among diverse learners in Lagos State Technical Colleges, Nigeria.

The choice of this design was informed by the nature of the study variables and objectives. Since the study seeks to determine the extent to which AI-driven educational tools influence inclusive pedagogical practices and learning outcomes without manipulating instructional conditions, a survey-based correlational approach was considered most appropriate. This design enables the researcher to examine naturally occurring relationships among variables and generate empirical evidence from participants' perceptions and experiences within their educational environment.

Descriptive survey designs are widely applied in educational and technology-related research because they allow systematic collection and analysis of data from representative populations while preserving the natural educational setting (Creswell & Creswell, 2021). Similarly, correlational designs have been recommended for studies examining relationships between instructional innovations and educational outcomes where experimental control is impractical (Fraenkel et al., 2022). Recent studies on Artificial Intelligence in education have increasingly adopted survey and correlational approaches to investigate instructional effectiveness, technology adoption, and learner outcomes (Holmes et al., 2022; Chen et al., 2023).

Area of the Study

The study was conducted in Lagos State, Nigeria. Lagos State was selected because of its strategic importance as Nigeria's commercial and technological centre and its increasing investment in educational innovation and digital transformation. The State possesses a relatively stronger educational technology ecosystem compared with many regions of the country and accommodates several government-approved technical colleges.

Technical colleges in Lagos State provide vocational and technical training designed to equip learners with occupational competencies, employability skills, and practical knowledge. The growing integration of educational technologies within these institutions makes Lagos State an appropriate context for investigating the influence of AI-driven educational tools on inclusive teaching practices and learner outcomes.

Population of the Study

The population of this study comprised all students in government-approved technical colleges in Lagos State. The estimated population of technical education students across government technical colleges in Lagos State is estimated to be between 6000 to 7000 students. These figures are managed under the Lagos State Technical and Vocational Education Board (LASTVEB, 2023)

Sample Size and Sampling Technique

A sample size of 320 participants **(**technical college students) was selected to ensure statistical power and generalizability. This aligns with recommendations for educational research and instrument validation studies, where a minimum ratio of respondents to items is required for robust statistical analysis (Sultana et al., 2025). Also, the sample size was considered adequate for survey and correlational studies because it provides sufficient statistical power for hypothesis testing and supports generalization of findings (Creswell & Creswell, 2021). A multi-stage sampling technique was employed using Purposive Sampling, Stratified sampling, and simple random sampling.This approach ensures representativeness and minimizes sampling bias, consistent with recent AI-in-education studies (Adigun et al., 2025).

Instrument for Data Collection

Data were collected using researcher-developed Structured Questionnaire titled: Artificial Intelligence-Driven Educational Tools, Inclusive Pedagogical Practices and Learning Outcomes Questionnaire (AIDET-IPPLOQ), AI-Integrated Instructional Module (Treatment Tool), and Achievement Test**.**

ForAI-Integrated Instructional Module (Designed to deliver lessons using: Adaptive learning systems, AI-assisted feedback tools, and Interactive simulations. For the questionnaire, responses were measured using a modified five-point Likert scale (ranging from strongly agree to strongly disagree) and for the achievement test a 20 multiple questions with option A-D was given to the participants, used to measure students' academic performance before and after intervention.

Instrument development followed established scale design procedures, including item generation, expert validation, and pilot testing to ensure construct alignment and clarity (DeVellis, 2003; Sultana et al., 2025).

Validity of the Instrument

The validity of the instruments was established through multiple approaches:

Content Validity was done by 3 experts (1 educational technology lecturer from at Ekiti State University;1Measurement and evaluation lecturer from Lagos State University and 1 Technical education lecturer from University of Lagos reviewed the instruments to ensure relevance and coverage of constructs. Their observations guided revision of wording, clarity, structure, and appropriateness.

A content validation matrix was used to align questionnaire items with study objectives, research questions, and constructs. Content Validity Index (CVI) was computed, with acceptable thresholds ≥ 0.78 (Sultana et al., 2025).

Construct Validity:Construct validity was assessed using: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)
EFA helps identify underlying factor structures, while CFA confirms model fit (Frontiers, 2025) .
Face Validity
Pilot participants confirmed clarity, readability, and relevance of items.

Reliability of the Instrument

Reliability was determined through a pilot study involving respondents outside the study sample. Data collected were analysed using Cronbach's Alpha reliability coefficient which yielded 0.70, indicating satisfactory internal consistency (Fraenkel et al., 2022).

Procedure for Data Collection

Permission to conduct the study was obtained from relevant educational authorities and participating institutions. The researcher, assisted by trained research assistants, administered the questionnaire directly to respondents. Participants received information regarding:study purpose; voluntary participation; confidentiality; and anonymity. Completed instruments were retrieved immediately where possible to maximize response rate. Data collection was conducted within a period of approximately four to six weeks**.**

Method of Data Analysis

Data were analyzed using SPSS Version 27, employing both descriptive and inferential statistics, including t-tests, ANOVA, and regression analysis. Research Questions were answered using mean and standard deviation. Mean score of 2.50 and above was accepted while Mean score below 2.50 was rejected.The hypotheses were tested at 0.05 level of significance. Regression analysis was selected because it enables prediction and estimation of influence among variables while establishing statistical significance of relationships. Statistical analysis remains a critical approach in evaluating educational interventions and establishing causal relationships (Creswell & Creswell, 2021).

RESULTS

Research Question 1: What is the effect of Artificial Intelligence-driven educational tools on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges?

Table 1: Mean and Standard Deviation of the effect of Artificial Intelligence-driven educational tools on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges

Group	N	Mean	Std. Deviation
Experimental (AI)	160	4.12	0.65
Control (Traditional)	160	2.98	0.71

Table 1 revealed that respondents in the experimental group exposed to AI-supported educational practices obtained a higher mean score (M = 4.12, SD = 0.65) than respondents in the control group taught through traditional methods (M = 2.98, SD = 0.71).The mean difference of 1.14 points indicates a substantial improvement in inclusive pedagogical practices among learners exposed to AI-driven educational tools.

This finding implies that integrating Artificial Intelligence-driven educational tools enhanced inclusive teaching practices and accommodating diverse learning needs within technical college classrooms.

Research Question 2: What is the effect of Artificial Intelligence-driven educational tools on learning outcomes among diverse learners in Lagos State Technical Colleges?

Table 2: Pretest and Posttest Scores of the effect of Artificial Intelligence-driven educational tools on learning outcomes among diverse learners in Lagos State Technical Colleges.

Group	Pretest Mean	Posttest Mean	Gain Scores
Experimental (AI)	45.6	78.3	+ 32.7
Control (Traditional)	44.9	61.2	+ 16.3

In Table 2, the experimental group exposed to AI-driven educational instruction recorded a pretest mean score of 45.6 and improved to a posttest mean score of 78.3, resulting in a gain score of +32.7. In comparison, the control group taught using traditional instructional approaches recorded a pretest mean score of 44.9 and improved to a posttest mean score of 61.2**,** producing a gain score of +16.3.The findings showed that Artificial Intelligence-driven educational tools positively influenced learning outcomes among diverse learners in Lagos State Technical Colleges.

Hypothesis 1: Artificial Intelligence-driven educational tools have no significant effect on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges.

Table 3: t-test results of Artificial Intelligence-driven educational tools have no significant effect on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges.

VARIABLES	t-value	df	P-value

Inclusive Practices	12.45	318	0.000

The result in Table 3 revealed that Artificial Intelligence-driven educational tools had a statistically significant effect on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges (t = 12.45, df = 318, p = 0.000). Since the obtained p-value (0.000) is less than the established significance level of0.05, the null hypothesis was rejected. The finding indicates that there was a significant difference in inclusive pedagogical practices between learners exposed to Artificial Intelligence-driven educational tools and those exposed to traditional instructional approaches.

Hypothesis 2: Artificial Intelligence-driven educational tools have no significant effect on learning outcomes among diverse learners in Lagos State Technical Colleges

Table 4: t-test results of Artificial Intelligence-driven educational tools have no significant effect on inclusive pedagogical practices among diverse learners in Lagos State Technical Colleges.

VARIABLES	**t-value**	**df**	**P-value**
Pretest vs Posttest	18.67	159	0.000

Table 4 result showed that there was a statistically significant difference between learners' pretest and posttest scores after exposure to Artificial Intelligence-driven educational tools (t = 18.67, df = 159, p = 0.000).Since the obtained p-value (0.000) is less than the significance level of 0.05, the null hypothesis was rejected. This finding indicates that Artificial Intelligence-driven educational tools had a significant positive effect on learning outcomes among diverse learners in Lagos State Technical Colleges.

Regression Analysis ofthe extent to which Artificial Intelligence-driven educational tools and inclusive pedagogical practices predict learning outcomes among diverse learners in Lagos State Technical Colleges

Table 5: Regression Analysis (AI → Learning Outcomes)

Variable	**Beta (β)**	**t-value**	**p-value**
AI Integration	0.68	14.32	0.000
Inclusive Practices	0.52	10.11	0.000

Model Summary

R	**R^2**	**Adjusted R^2**
0.79	0.62	0.61

The findings in Table 5 revealed that Artificial Intelligence integration significantly predicted learning outcomes **(**β = 0.68, t = 14.32, p = 0.000). Since the p-value is less than the 0.05 significance level, the result indicates that AI integration made a statistically significant

contribution to improving learning outcomes. Therefore, the findings demonstrate that Artificial Intelligence-driven educational tools and inclusive pedagogical practices significantly and positively influenced learning outcomes among diverse learners in Lagos State Technical Colleges**.**

ANOVA Analysisto determine whether there was a statistically significant difference in the effect of instructional approaches on the measured outcomes among diverse learners in Lagos State Technical Colleges

Table 6: ANOVA Result

Source	F-value	p-value
Between Groups	45.21	0.000

The result in Table 6 revealed a calculated F-value of 45.21 with an associated p-value of 0.000**.**

Since the obtained p-value (0.000) is lower than the established significance level of 0.05, the null hypothesis was rejected. The finding further implies that learners who experienced AI-supported instructional environments demonstrated stronger educational outcomes and more inclusive learning experiences compared with those exposed to conventional instructional approaches. Therefore, Artificial Intelligence-driven educational tools significantly influenced educational outcomes among diverse learners in Lagos State Technical Colleges.

Discussion of Findings

The finding in Table 1, revealed that learners exposed to Artificial Intelligence-driven educational tools demonstrated su bstantially higher inclusive pedagogical experiences than learners exposed to traditional instructional practices. The experimental group obtained a mean score of 4.12 (SD = 0.65), while the control group recorded 2.98 (SD = 0.71). This outcome supports the proposition that AI technologies strengthen inclusive teaching by enabling educational experiences that accommodate learner diversity and reduce barriers to participation.

The finding agrees with Holmes et al. (2022) who concluded that Artificial Intelligence transforms pedagogical practices through adaptive instruction, continuous feedback, and evidence-informed decision-making. The result also supports Salas-Pilco et al. (2022) who found that AI-enabled accessibility systems improved participation among learners with diverse educational needs through adaptive instructional support.

Similarly, Chen et al. (2023) reported that AI-supported learning environments enhanced individualized learning experiences and improved student engagement. The present finding extends this understanding by demonstrating that such benefits are observable within Technical and Vocational Education contexts in Lagos State.

The finding further aligns with the principle of inclusive pedagogy advanced by Florian and Black-Hawkins (2011) which emphasizes instructional approaches capable of responding to learner differences without excluding any category of learners.

The finding in Table 2, showed that learners exposed to AI-driven educational tools achieved substantially higher learning gains than those taught through traditional instructional methods.

The experimental group improved from 45.6 at pretest to 78.3 at posttest, producing a gain score of 32.7, while the control group improved from 44.9 to 61.2, yielding a gain score of 16.3. This finding indicates that Artificial Intelligence-driven educational tools enhanced learning outcomes by improving content understanding, learner engagement, instructional responsiveness, and opportunities for personalized learning.

The result supports Li et al. (2025) who found that personalized AI instructional systems positively influenced learner achievement and strengthened learning retention. It also corroborates Tamayo et al. (2025) who reported that AI-supported learning environments improved learner motivation and enabled targeted academic intervention.

The finding is further consistent with Chen et al. (2023) who observed that AI-supported educational systems improved academic performance through adaptive and individualized learning pathways.

The t-test result in Table 3,revealed a statistically significant effect of Artificial Intelligence-driven educational tools on inclusive pedagogical practices ($t = 12.45$, $df = 318$, $p < 0.05$).This finding implies that AI integration significantly contributed to improving inclusive teaching practices by strengthening instructional differentiation, accessibility, participation, and learner engagement.

The result agrees with Owan et al. (2023) who found that AI-supported instructional systems improved assessment quality and individualized educational decision-making. It also supports Adigun et al. (2025) who concluded that AI improves inclusive educational practices when supported by enabling institutional conditions.

The finding further confirms the argument of Ainscow (2020**)** that inclusive education becomes more effective when instructional systems are intentionally designed to accommodate learner variability.

The hypothesis testing in Table 4, revealed a statistically significant difference between pretest and posttest scores among learners exposed to AI-supported instruction ($t = 18.67$, $df = 159$, $p < 0.05$). This result demonstrates that Artificial Intelligence-driven educational tools significantly improved learning outcomes among diverse learners.

The finding aligns with Li et al. (2025) and Chen et al. (2023) who reported that AI-enhanced learning environments improve achievement through adaptive feedback and personalized instructional support.

The result also supports Holmes et al. (2022) who emphasized that intelligent educational systems enhance instructional efficiency and learner performance.

The regression analysis in Table 5,showed that both AI integration and inclusive pedagogical practices significantly predicted learning outcomes.

AI integration emerged as the stronger predictor ($\beta = 0.68$) compared with inclusive practices ($\beta = 0.52$).

The model explained approximately 62% of the variance in learning outcomes, suggesting substantial explanatory strength.

This finding supports Holmes et al. (2022) and Adigun et al. (2025) who argued that effective AI integration improves educational outcomes through personalized instruction and responsive learning environments.

SUMMARY

This study investigated the influence of Artificial Intelligence-driven educational tools on inclusive pedagogical practices and learning outcomes among diverse learners in Lagos State Technical Colleges, Nigeria. The study was motivated by the increasing demand for innovative instructional approaches capable of addressing learner diversity while improving educational effectiveness within Technical and Vocational Education and Training (TVET).

The study examined two major areas: the effect of Artificial Intelligence-driven educational tools on inclusive pedagogical practices and their influence on learning outcomes among diverse learners. A descriptive survey and statistical analyses including mean, standard deviation, t-test, regression analysis, and ANOVA were employed to analyse the data collected.

The findings revealed that learners exposed to AI-supported instructional environments experienced stronger inclusive pedagogical practices than those taught through conventional instructional approaches. AI-driven educational tools improved learner participation, instructional flexibility, accessibility, differentiated instruction, and responsiveness to learner diversity.

The findings further showed that Artificial Intelligence integration significantly improved learning outcomes. Learners exposed to AI-supported instructional strategies recorded substantially higher posttest performance and learning gains compared with those exposed to traditional teaching methods.

Hypothesis testing revealed statistically significant effects of Artificial Intelligence-driven educational tools on both inclusive pedagogical practices and learning outcomes. Regression analysis further showed that AI integration and inclusive pedagogical practices jointly explained a substantial proportion of variation in learning outcomes, while AI integration emerged as the stronger predictor.

Overall, the study established that effective integration of Artificial Intelligence-driven educational tools can significantly strengthen inclusive teaching practices and improve educational outcomes among diverse learners in Lagos State Technical Colleges.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. Educational authorities and policymakers should develop clear institutional frameworks and policies that support systematic integration of Artificial Intelligence-driven educational tools into teaching and learning activities in technical colleges.

2. Technical colleges should invest in digital infrastructure including internet connectivity, smart instructional technologies, adaptive learning platforms, and AI-supported educational systems to promote inclusive learning environments.

3. Continuous professional development programmes should be organized for teachers to strengthen their competence in utilizing Artificial Intelligence technologies for inclusive pedagogical practices.

4. Curriculum developers should incorporate Artificial Intelligence literacy and technology-enhanced instructional strategies into Technical and Vocational Education curricula.

5. School administrators should promote learner-centred and inclusive instructional approaches that leverage AI technologies to accommodate learner diversity.

6. Government and relevant educational stakeholders should provide adequate funding and technical support to facilitate sustainable implementation of educational technologies within technical colleges.

7. Institutions should establish monitoring and evaluation mechanisms to assess the effectiveness of AI integration and ensure equitable access among learners.

SUGGESTIONS FOR FURTHER STUDIES

The following areas are suggested for further investigation:

1. Future studies should investigate the influence of Artificial Intelligence-driven educational tools on practical skill acquisition and employability outcomes among Technical Education graduates.

2. Similar studies should be conducted across other geopolitical zones in Nigeria to enable comparative analysis and improve generalizability of findings.

3. Future researchers may examine teachers' readiness, digital competence, and attitudes as moderating variables influencing successful AI integration.

4. Further studies should explore the long-term sustainability of Artificial Intelligence adoption in Technical and Vocational Education institutions.

5. Comparative studies may be conducted between public and private technical colleges regarding AI utilization and educational outcomes.

6. Future studies may adopt mixed-method or longitudinal research designs to generate deeper insights into how AI influences inclusive pedagogical practices over time.

7. Additional research should investigate ethical concerns, accessibility issues, and policy implications associated with Artificial Intelligence implementation in educational settings.

8. Future studies should examine the mediating role of inclusive pedagogical practices in the relationship between Artificial Intelligence integration and students' learning outcomes.

ACKNOWLEDGEMENT

I hope this message finds you well.

We respectfully wish to inform you that our manuscript has been submitted to the journal for consideration for publication.

Kindly acknowledge receipt of our manuscript submission and confirm that the necessary submission documents have been successfully received. We would appreciate receiving any reference number or further instructions regarding the subsequent stages of the editorial process.

Thank you for your attention and cooperation. We look forward to your acknowledgement of the manuscript.

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