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Developing Adaptive Learning Systems Leveraging Artificial Intelligence for Personalised Education in Nigeria

Danladi Moses ADAYILO[1] , Ishaq Oyebisi OYEFOLAHAN[2], Juliana Ngozi NDUNAGU[3], Nwando ANEKWE[4], Chinedu OTUYA[5], Esther Omowumi LADAN[6]

Africa Centre of Excellence on Technology Enhanced Learning, National Open University of Nigeria, Plot 91, Abuja 900108, Nigeria. Email: ace22160005@noun.edu.ng, danladimosesadayilo@gmail.com

Africa Centre of Excellence on Technology Enhanced Learning, National Open University of Nigeria, Plot 91, Abuja 900108, Nigeria. Email: ioyefolahan@noun.edu.ng

Department of Computer Science and Information Technology, Faculty of Science, National Open University of Nigeria, Plot 91, Abuja 900108, Nigeria, Email: jndunagu@noun.edu.ng

Directorate of Management Information System, National Open University of Nigeria, Plot 91, Abuja 900108, Nigeria, Email: nanekwe@noun.edu.ng

Africa Centre of Excellence on Technology Enhanced Learning, National Open University of Nigeria, Plot 91, Abuja 900108, Nigeria. Email: ace2225013@noun.edu.ng; ccotuya@nuc.edu.ng

Africa Centre of Excellence on Technology Enhanced Learning, National Open University of Nigeria, Plot 91, Abuja 900108, Nigeria. Email: ace2225010@noun.edu.ng; estherladan1@gmail.com

ABSTRACT

The study investigates how AI-based Adaptive Learning Systems (AI-ALS) with respect to promoting personalised education in Nigerian secondary schools' context, and its impact on academic performance and user satisfaction. The study employed mixed-method with a quasi-experimental design to collect data at four public and private schools in Abuja and Lagos (n=200) participants in the experiment AI group, and the traditional control group. The quantitative findings showed that adaptive AI tools had a good effect on student achievement over other the traditional mode of teaching. AI-ALS group got an improvement of 0.24 SD ($p < 0.01$) in English, and a 0.35 SD in Mathematics ($p < 0.05$). Thematic analysis on perception and engagement as reported by the respondents was high where personalised feedback and self-learning made them feel more motivated. Infrastructure and privacy issues were mentioned by the teachers and students as the major obstacles to adoption, but their support had moderate levels. The results revealed that adaptive AI systems could have a meaningful impact on improving the outcomes and engagement of learning in the education domain of Nigeria, provided there is adequate infrastructure, educator preparedness and design consideration. The study highlights that AI has the potential to transform equitably, professionally recorded, and scalable personalised learning. The paper recommends the partnerships between technology developers and educational policy makers in an attempt to sustain adaptive learning systems in the Nigerian education system.

Keywords: Artificial Intelligence, Adaptive learning, Personalised education, Academic performance, Nigeria.

1.0 INTRODUCTION

Artificial Intelligence (AI)-based Adaptive Learning System (AI-ALS) can be defined as a disruptive form of learning, allowing customised learning which adapts to each learner regarding needs, paces, and finesse (Chan and Li, 2025). In Nigeria, the education systems are changing due to the development of digital education, adaptive platforms, suggested by the use of AI, can potentially improve the effectiveness of teaching and learning, especially in settings with limited resources (Bali *et al.*, 2024; Akaeze and Akaeze, 2024; Abubakar et al., 2025, Ezzaim *et al*., 2025).

Nigeria has continued to experience numerous issues related to their education sector and they are overcrowded, poor infrastructure, lack of access to good resources and, most importantly high rate of dropouts further enhanced by socioeconomic inequalities and the uneven technology

uptake. Such problems are impediments to individual learning and result in inefficient learning outcomes and disparities of inequality, particularly in rural and marginalised communities (Akintola *et al.,* 2025; Bali *et al.,* 2024; Ezzaim *et al*., 2023). Although AI technologies provide the way out with adaptive contents and real-time feedback, their introduction faces obstacles in the form of digital literacy, untrusted internet access, and the ethical considerations (Ndunagu *et al.,* 2025; Papakostas, 2025; Wang *et al*., 2025; Alalawi *et al.,* 2024; Alawawi et al., 2023).
This paper attempts to explore adaptive learning systems using AI that are adapted to individualised learning models in Nigerian secondary schools and determine the implications of such systems on student achievement, student engagement, and equity in student achievement (Ayeni *et al*., 2024; Hatoon *et al*., 2024; Karakose, 2024); Khlaif *et al*., 2024; Zou *et al.*, 2025) This study will add to the accumulating literature of technology-enhanced learning in developing-country contexts, as the study presents an empirical measure of AI efficacy in the context of Nigeria, which in turn aids in developing scalable uses of AI and sealing gaps in adaptive educational approaches.

The theoretical framework of the study as presented in Figure 1 is inspired by five different lenses such as the Two-Sigma Problem proposed by Bloom, Technology Acceptance Models (TAM/UTUAT), Teaching at the Right Level (TaRL), methodology extended by creating generative artificial intelligence and adaptive technologies to allow real-time personalisation depending on the Nigerian curriculum (De Simone et al., 2025; Abubakar *et al*., 2025; *Yakubu et al.*, 2025).

The main idea in the framework which assumes the ability of the AI adaptive systems to take the advantage of the one-on-one tutoring method by adjusting the rate of content, pacing and feedback based on the data of learners in order to provide the engagement, retention and equity of the results (Oloyede, 2025; De Simone *et al.,* 2025). It also integrates machine learning (ML) and natural language processing (NLP) features in personalisation of paths, considering local impediments, including unreliable internet connection and digital gap, and integrates TAM/UTUAT for user acceptance and adoption of technology (Yakubu *et al.,* 2025; Birma *et al.,* 2025; Ndunagu *et al*., 2025; Bali *et al*., 2024; Owoc, 2021).

The scientific research shows that adaptive systems with AIs enhance the academic achievements in Nigeria. Study conducted by De Simone *et al.* (2025) highlighted that the secondary school based on quasi-experimental, students in AI tutoring systems performed better in mathematics and English whereas the effect sizes were 0.4 to 0.6 out of students taking part in the quasi-experimental study than those not participating in the use of AI tutoring systems did. On the same note, Ogoke *et al.* (2025); Nguyen & Truong, (2025) and Oloyede, (2025) observed a notable improvement of the results of university students studying science topics; because of real-time feedbacks and the personalisation of the materials. These results are consistent with international experience with the use of AI in the context of low-resource settings (Capinding and Dumayas, 2025; Melo-lopez *et al*., 2025; Meino-campo, 2025; Bañeres *et al*., 2023).

The adoption of the system is dependent on user mobilisation as highlighted by Ogoke et al. (2025); and Mienye *et al.* (2025) studied the usage of AI platforms among secondary school students, indicating their social interactions were high because the platform was focused on gamification and adaptive feedback, which was low-cost because of students' lack of digital literacy. Kayode and Odumabo (2024) established that the Nigerian university students confirmed that

AI systems offered flexibility and they were worried about technical glitches and privacy of their data. The opinions of the teachers were ambivalent as some found it beneficial to have less work to do, but others believed that they were not ready to implement AI (Chidinma and Yinka, 2025; Olatunde-Aiyedun *et al*., 2024; Alalawi, *et al.*, 2024; Lushyn and Sukhenko, 2024).

There are all barriers on infrastructure and accessibility. Study conducted by Birma *et al.* (2025); Ndunagu *et al.*, (2025), pointed out that limited internet and electricity are the significant problems that hinder the deployment of AI systems in Nigerian schools in rural areas. According to Yakubu *et al*. (2024); Abubakar *et al*. (2024); Alonso *et al.* (2025) pointed out that the scalability is also complicated by the fact that AI infrastructure is expensive, and a low level of digital literacy shows among educators. These difficulties follow the idea of context-dependent solutions that would guarantee the equal access (Alotaibi, 2024).

The studies conducted by previous researchers revealed that AI can improve the learning outcomes and engagement in Nigeria, especially in personalised instruction (Ogoke *et al*., 2025; De Simone *et al.,* 2025; Farhah *et al.,* 2025; Fernandez-Morante, 2021). There is however a divergence in the approach of implementation barriers. On the one hand, Olatunde-Aiyedun *et al.* (2025) promote teacher training to diminish the digital literacy disparity; however, on the other hand, Birma *et al.* (2025) focus more on the infrastructure investment as the priority measure. It also does not appear to discuss ethical issues, including data privacy, unequally, with Kayode and Odumabo (2024) illegitimately addressing them, unlike other articles.

Although the evidence is increasingly growing, few studies emphasise research on long-term ramifications of AI adaptive system on equity and retention in Nigerian secondary education (Ogoke *et al*., 2025; Agadada and Ekwevugbe, 2025). Majority of studies are done on a short-term basis with scarce investigations of scalable, context implicit models which would help solve inequalities between rural and urban areas (Birma *et al.,* 2025). The gap in this study identified is that the AI-driven adaptive system based on the specifics of the Nigerian secondary school should be developed and evaluated alongside a longitudinal outcome, equity, and stakeholder-engagement focus. A mixed-methods evaluation of the academic performance, user experiences, and implementation barriers was carried out to offer a multifaceted set of evaluation standards regarding the guidelines of the sustainable AI integration (Malik *et al*., 2021).

The study is guided by two research objectives (1) to assess the effectiveness of AI-based adaptive learning systems in academic performance improvement in mathematics and English than in the traditional teaching method applied to Nigerian secondary school students, (2) to examine the perception and engagement rates of teachers and students when they have experiences with AI-based adaptive learning systems, and how it affects system adoption rates.
The rest of the paper is structure as follows: Section 2 discusses about the material and methods, section 3 dwell on the result and discussion while section 4

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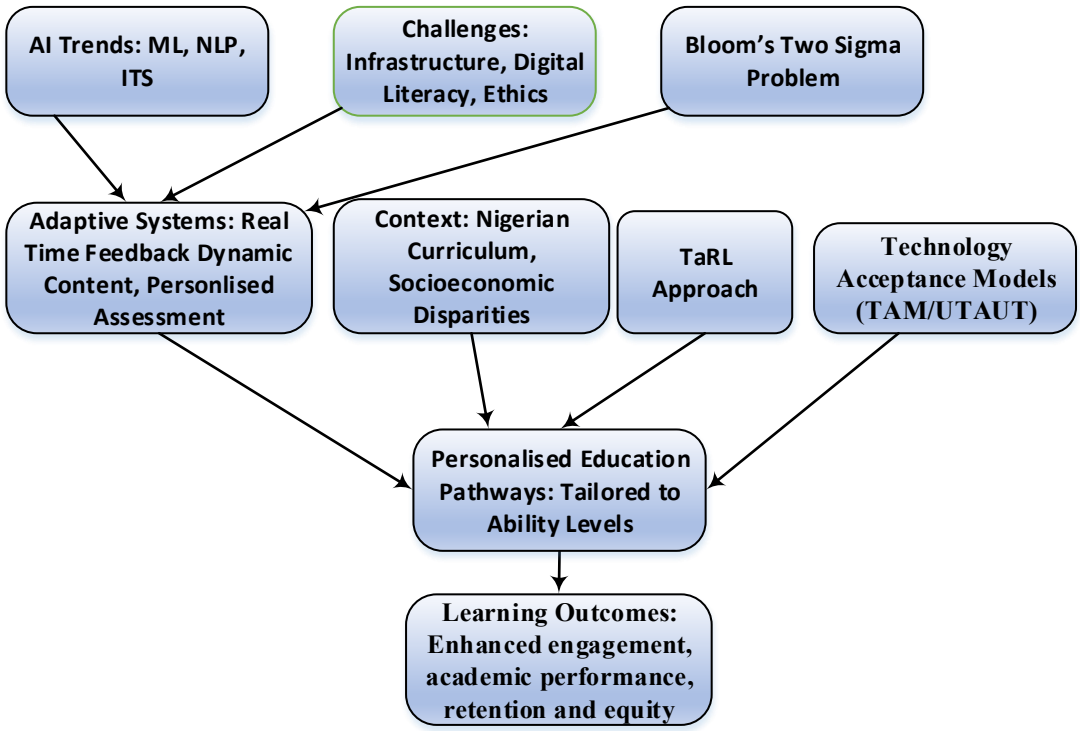

Figure 1: Theoretical Framework of Adaptive Learning System using AI for Personalised Education in Nigeria (Source: Adayilo *et al.,* 2025)

2.0 METHOD AND MATERIALS

2.1 Research design

This paper used a mixed-method with a quasi-experimental approach to examine and test a personalised education adaptive learning system based on AI in Nigerian secondary schools. The scheme combined both quantitative and qualitative analysis of the learning results and qualitative analysis about user experience and the usability of the system. Quasi-experimental design was chosen because of practical reasons, which permitted comparisons of an experimental group with the AI system with other control group (the application of traditional instruction). This is the methodology adopted by other comparable empirical studies about AI in education in third world settings (Maraza-Quispe *et al*., 2025, Malik *et al.,* 2021).

The growth phase Incorporated the iterative design of the adaptive system that included machine learning algorithms to implement adaptive content in real-time, with performance data about students. The assessment period took 2 weeks, and the subjects that were considered were English language and mathematics according to the Nigerian curriculum.

2.2 Population sampling and selection criteria

The study population included secondary schools' students and teachers of four selected public and private schools in Abuja and Lagos, Nigeria. The study sample was comprised of 200 participants who were divided into equal with half in the experimental group that used the AI-ALS platform and half in the control group having the traditional instruction. The respondents were eligible students in the Senior Secondary classes (SS1-SS3) with exposure to both English and Mathematics with some fundamental digital literacy and informed consent. One of the selection criteria of teachers consisted in subject expertise, the existence of at least three years of teaching experience, and willingness to integrate technology, provided that the teachers received AI-ALS orientation. Purposeful and stratified sampling methods were used to select the sample to provide a representation based on gender, type of school and the

socio-economic background. Stratification was used to ensure that both private and public schools were sampled equally whereas purposive selection was used to make sure that the schools involved in the research possessed basic ICTs and were willing to implement AI-based tools within the study duration. This sampling allowed making a fair comparison of groups and allowed increasing the validity of the findings in other similar educational settings in Nigeria.

2.3 Validity and reliability

To gain validity, the study adopted the mixed-method and quasi-experimental design which was suitable to enable triangulation of both quantitative and qualitative data hence improving the validity and reliability of the results. The utilisation of a control group (traditional instruction) and an experimental group (AI-ALS) allowed the internal validity as the extraneous variables were compared, and their control was achieved. The pre-test and post-test design assisted to determine the actual improvements in learning which could be credited to the adaptive learning systems which were based on AI. The obvious content validity was upheld by ensuring the correspondence of the test tools and perception surveys to the Nigerian secondary education curriculum and the accepted educational measurement standards. Reviewing of the instruments by education technologists and teachers also proved their applicability and suitability. Reliability was achieved by pilot testing the instruments prior to complete implementation and this helped in refining ambiguous items and enhancing consistency. Perception scales were calculated to determine internal consistency, and the coefficient of Cronbach α gave decent degrees of reliability ($\alpha = 0.80$). Statistical tests ($p < 0.05$ $p < 0.01$) were also used to find significant effects of the presented quantitative data whereas the qualitative interview responses were cross-checked with each other and thematically coded to check the inter-rater reliability. All of these actions increased the credibility, reproducibility, and strength of the results of the study (Metlilo and Yıldırım, 2025; Yıldız-Çelik and Uğur, 2025; Avinç and Doğan, 2024).

2.4 Data collection

The mixed-method and quasi-experimental design was used to gather information on the efficiency of AI-based Adaptive Learning Systems (AI-ALS) that could be used to facilitate personalised education in Nigerian secondary schools. The data were collected at four schools (two in Abuja and two in Lagos) of different types, i.e., a public and a private school, with a total number of 200 participants who were divided into two groups, an experimental group using AI-ALS platform and a control group receiving school-based instruction. According to the measures of academic performance difference in the groups, quantitative data were gathered by using pre-test and post-test in English and Mathematics. The tests were constructed based on the Nigerian secondary school curriculum and subject specialists were used to verify the useability of the tests. Students and teachers were given perception surveys on a 5-point Likert scale to determine the levels of user satisfaction, engagement, and level of motivation. Semi-structured interviews and focus group discussions with the teachers and selected students to discuss their experience, perceptions, and challenges related to AI-ALS implementation were the means of acquiring qualitative data. The interviews gave the background aspect (infrastructure, teacher preparedness, and privacy concerns). The data were all gathered in an ethical manner, with voluntary participation, confidentiality, and informed consent of the schools and subjects involved.

2.5 Data analysis techniques

The study used both the quantitative and qualitative data analysis methods as part of its mixed-method and quasi-experimental research design. Descriptive and inferential statistics were used in analysing quantitative

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data collected with pre-test and post-test scores in English and Mathematics using python to define the influence of Artificial Intelligence (AI-Based Adaptive Learning Systems (AI-ALS)) in improving student performance. Summary of both the achievement and level of engagement among the students were done using descriptive statistics like means, standard deviations and percentages, including inferential statistics like the t-test and the Analysis of Covariance (ANCOVA) were used to determine the variation in performance of the experimental (AI-ALS) and the control (traditional) students. To calculate the levels of difference observed and their degree of reliability, effect sizes (Cohen d) and significance levels ($p < 0.05$ and $p < 0.01$) were computed.

In the qualitative aspect, thematic analysis with NVivo software was performed to analyse data about interviews and focus groups of teachers and students. Coding, categorisation, and interpretation of the responses were done to determine major themes as perceptions, motivation, infrastructure issue and readiness to adopt. Quantitative and qualitative Triangulations enhanced validity of the results, and gave an overall perception on the usefulness and experience of the AI-ALS in the Nigerian secondary schools.

2.5 Ethical considerations

The study was ethical in that it informed consent to all the students and teachers involved including the school authority before it was conducted. The privacy and confidentiality of participants were also taken care of, particularly the application of AI systems to analyse the data of learners. The participant details were anonymised to avoid the possibility of identification and the participation was voluntary, as there was no withdrawal penalty. The study was also ethical in its own institutional standards and the proper utilisation of AI in order to prevent bias or damage. There was a particular emphasis on equal access and gender equality in the application of adaptive AI tools, allowing the identification of possible gaps in the digital capital of schools. The paper conformed to the Nigerian Data Protection Act (NDPA), 2023 in its entirety.

3.0 RESULTS AND DISCUSSION

The result of findings is based on the study two Research Objectives (RO) including (1) to assess the effectiveness of AI-based adaptive learning systems in academic performance improvement in Mathematics and English than in the traditional teaching method applied to Nigerian secondary school students, (2) to examine the perception and engagement rates of teachers and students when they have experiences with AI-based adaptive learning systems, and how it affects system adoption rates. The basis of these findings relies on the expansion of quasi experimental and survey-based findings, in which case effect size, statistical significance and perceptions have been the area of focus.

The demographic summary data of the respondents is presented in Table 1- 9 below:

Table 1: Role of the Respondents

Variable	Category	Frequency	Percentage
Role	Students	140	70
	Teachers	60	30
Total		200	100

Table 2: Age of the Respondents

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Variable	Category	Frequency	Percentage
Age	Students (15-20)	140	70
	Teachers (21-50+)	60	30
Total		200	100

Table 3: Gender of the Respondents

Variable	Category	Frequency	Percentage
Gender	Female	120	60
	Male	80	40
Total		200	100

Table 4: Location of the Respondents

Variable	Category	Frequency	Percentage
Location	Abuja	2	50
	Lagos	2	50
Total		4	100

Table 5: Class of the Respondents (Students)

Variable	Category	Frequency	Percentage
Class	SS1	35	25
	SS2	45	32.2
	SS3	60	42.8
Total		140	100

Table 6: School Type of the Respondents

Variable	Category	Frequency	Percentage
School Tye	Private	2	50
	Public	2	50
Total		4	100

Table 7: Qualification of the Respondents (Teachers)

Variable	Category	Frequency	Percentage
Qualification	NCE	10	16.7
	B.ED/BSc.ED	25	41.7

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	PGDE	15	25
	M.ED/MSc.ED	8	13.3
	PhD	2	3.3
Total		60	100

Table 8: Experience of the Respondents (Teachers)

Variable	Category	Frequency	Percentage
Experience	3-5	33	55
	6-10	20	33.3
	10+	7	11.7
Total		60	100

Table 9: Assigned Group of the Respondents

Variable	Category	Frequency	Percentage
Assigned Group	Experimental	100	50
	Control	100	50
Total		200	100

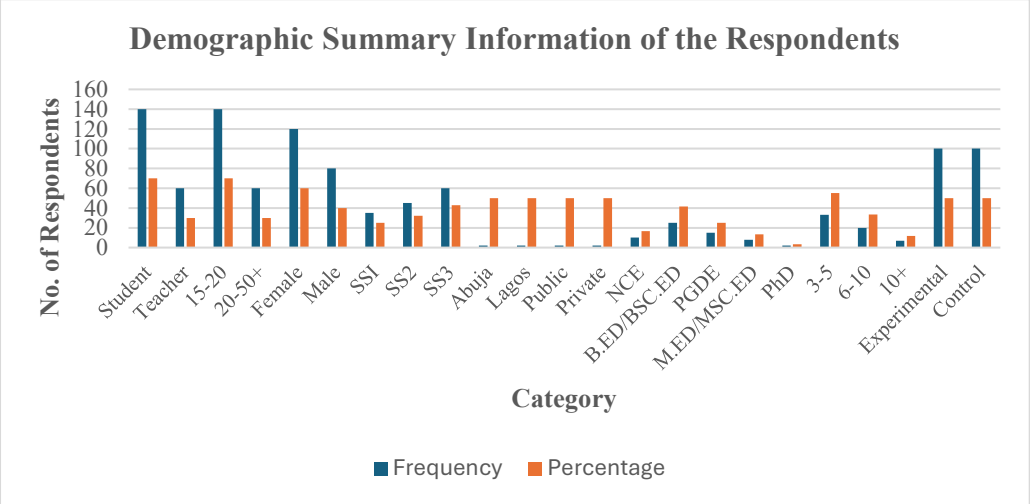

Figure 2: Graphical Representation of the Demographic Summary Information of the Respondents

The demographic summary information of the respondents as presented in Table 1 - 9 revealed the number of the respondents (students and teachers) with their age, gender, location of school, school type, class of students, qualification of teachers and their experience including the assigned groups (experimental and control) respectively.

In case of RO1, the increase in academic performance has been presented in Table 10 and Figure 3 mean score on a 5-point Likert

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scale (1 = strongly disagree, to 5 = strongly agree). While RO2, the thematic analysis of perception, challenges and readiness findings is presented in Table 3 with high positive reflection of perceived benefits, willingness and readiness to adopt AI adaptive learning system but with moderate challenges of infrastructural gaps such as inadequate devices, limited internet access and staff training among others.

Research Objective (EO) 1: Impact of AI on academic performance in Mathematics and English.

Table 10: Pre-Test and Post-Test overall Means and changes by Subject and Groups

Subject	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Gain	Effect Size (Cohen's d)
English	AI-ALS (50)	50.2 (10.5)	65.3 (9.8)	15.1	0.24
	Control (50)	49.8 (10.7)	55.2 (11.2)	5.4	-
Mathematics	AI-ALS (50)	45.6 (12.1)	62.4 (11.0)	16.8	0.35
	Control (50)	46.1 (12.3)	52.3 (12.5)	6.2	-

Note: Scores are converted to wins out of 0-100 scale; Randomised Controlled Trial (RCT) data used sample weights to come up with engagement-related results with n=100 English and gleaned using surveys with n=100 math).
The complete text below showed a bar graph (gain) with (vertical axis) (gain score) and (horizontal axis) (groups by subject). There is a much higher gain in the experimental groups.

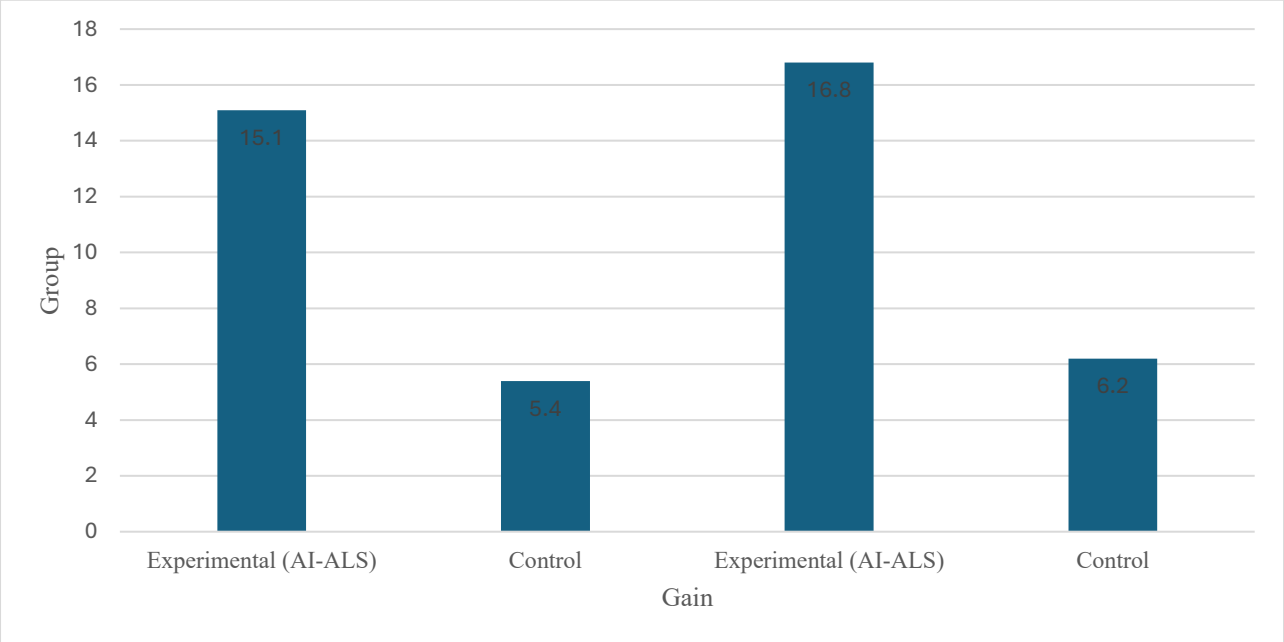

Figure 3: Gain in Experimental and Control Group

Research Objective (RO) 2: Perceptions, Level of Engagement and Influence to Adoption.

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Table 11: Perception, Engagement and Challenges of Students and Teachers AI Adoption

Themes/Sub-Themes	Qualitative Code	Frequency of Mentions	Representative Participant Expressions (Short Quotes)	Interpretation	Theoretical Corresponding Construct
Perceived Personalisation	Students value personalised guidance	High	I feel the support that is frequently proposed	Within the framework of AI, there is trustworthy	TAM/UTAUT
	Teachers are uncertain about transparency	Moderate	The instructors do not disregard the value but continue to be cynical about the algorithmic decisions.	Within the framework of AI, I have to go steer the guidance that is often times provided to me.	TAM/UTAUT
Engagement and Motivation	More student engagement	High	It makes me active since it demonstrates my improvement	Students show strong motivational shifts driven by real-time feedback.	Bloom Two Sigma Theory, TAM/UTAUT
	Teacher workload concerns	Moderate	It helps students, but it adds more monitoring work for me.	Teachers see engagement benefits but also experience added responsibilities	TaRL, AI methodology
Challenges and Barriers	Technical errors disrupting flow	High	Once it hangs, learning stops immediately	One of the most mentioned barriers was system instability	Facilitating conditions
	Privacy and data concerns	Moderate	We don't know who is seeing our data.	There was a concern of both teachers and the students with regard to sensitive information	Trust and Ethical Issues
	Burden of troubleshooting among teachers	High	I have been doing a lot of troubleshooting more than teaching.	Teachers will face challenges to a greater extent than the students.	TaRL, AI methodology
Adoption Intent	Students would use it and should the benefits remain	High	I will use it should it continue to offer me good learning faster	Attention of students is motivated by the perceived benefits of learning.	Trust and Ethical Readiness, TAM/UTAUT
	Reliable infrastructure is needed by teachers	High	Should the network crash, the entire lesson will fall apart.	Adoption intention for teachers is tied to system reliability and support	Facilitating conditions
	Departmental differences in readiness	Moderate	We are already used to digital tools, so it fits us	Tech-oriented learners feel more comfortable adopting AI tools.	Trust and Ethical Readiness

3.1 DISCUSSION

The results prove that AI-based adaptive systems are more effective in improving academic outcomes than conventional approaches according to the international tendencies in low-resource environments,

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but specific to the context of Nigeria (Bali *et al.,* 2024 Ndunagu *et al*., 2025).

The demographic summary information of the study as presented in Table 1-9, revea the number of respondents (n=2 comprising (n=140 students) 70% and (n=60 teachers) 30% representation. The overall age bracket that has the highest participation among the students was between 15-20 years representing 70% of the sample learners while the teachers age bracket is between 20-50+ representing 30% of the sample population. The female gender had the overall highest number of respondents (n=120) with 60% while the male gender was (n=80) with 40% of the sample population. The SS3 students had the highest number of respondents among the students with 60 participants representing 42.8%, followed by SS2 with 45 participants representing 32.3 and the least was SS1 with 35 participants representing the 70% of the sample population. The teachers with B.ED/BSc.ED qualification recorded the highest number of participants with 25 representing 41.7%, followed by PGDE with 15 participants representing 25%, and NCE with 10 participants representing 16.7%, while M.ED/MSc.ED had 8 participants representing 13.3% and the least was those with PhD with 2 participants representing 3.2% of the teachers (30%) of the sample population. The teachers with 3-5 years of experience recorded the highest number in the survey with 33 participants representing 55%, while those with 6-10 years of experience recorded 20 participants representing 33.3% and those with 10 years and above had 7 participants representing 11.7% of the teachers (30%) of the sample population.

Generally speaking, the study demographic information is well spread among the students and the teachers as it represents the true reflection of the respondents across the four selected secondary schools (2 public and 2 privates) in Abuja and Lagos respectively.

3.2 Research Objective (RO) 1: Impact of academic performance in Mathematics and English

As presented in Table 10 and Figure 3, they showed great improvement of both English and mathematics as the AI helps deal with increased in learning outcomes.

In the English Experimental (AI-ALS) group: the mean score rose by 15.1 points demonstrating an increase in 50.2 to 65.3. The small-to-moderate improvement because of the AI-based Adaptive Learning System (AI-ALS) is shown by the effect size (Cohen's d = 0.24).

Control group: A score range rose marginally between 49.8 and 55.2 which was a 5.4 payoff. The size of the effect does not determine any effect card, but the improvement is significantly lower than the experimental group.

English interpretation: Students who were exposed to the AI-ALS had better English performance results than students in the control group. It may be supposed that the adaptive learning intervention driven by AI had a beneficial effect on the outcomes of language learning.

Mathematics Experimental (AI-ALS) group: The mean score increased by 16.8 points to reach 62.4. Cohen d (0.35) determines the effect to be moderate implying that the intervention did bring about an observable effect on learning makes. Control group: The mean score has gone up by 6.2 with an increase in the score to 52.3 out of 46.1.

Interpretation of Mathematics: The AI-ALS group scored significantly higher learning gains compared to the control group implying the high level of impact of the system to mathematics success. 3. Overall Trend In both courses, Experimental (AI-ALS) group achieved higher results compared to Control group following the intervention. Mathematics has a stronger gain and an effect size as compared to English and this means that adaptive AI tools can work

especially on the quantitative aspect or problem-solving approach. All the findings tend to indicate that AI-based adaptive learning systems have a high potential to transform the learning outcome of students as compared to the traditional process of aiding instructions to the students

3.3 Research Objective (RO) 2: Perceptions, Level of Engagement and Influence to Adoption

As presented in Table 11, it has revealed the factors such as perceived personalisation (TAM) with High frequency mentioned by the students while Teachers were uncertain about transparency. Also, in Engagement and Motivation (Two Sigma Bloom, TaRL AI methodology), the students were more engaged with High frequency reported while the Teacher workload was a concern with moderate frequency mentioned. Challenge of technical errors (facilitating condition) disrupting flow with High frequency reported, Privacy and data concerns (trust and ethical readiness) with Moderate frequency mentioned, Burden of troubleshooting among teachers with High frequency reported. Adoption intention (facilitating conditional), students have intention to use the solution should the benefit remains with High frequency mentioned while the Teachers stated the need to have a reliable infrastructure with High frequency mentioned. There was also departmental difference by teachers' readiness of AI adoption with Moderate frequency mentioned. Altogether, the results will fill gaps in the literature on long-term equity which can show scalable effects.

Theoretically, these results from this study aligned with the Two-Sigma Problem proposed by Bloom, Technology Acceptance Models (TAM/UTAUT), Teaching at the Right Level (TaRL), AI methodology extended by creating generative artificial intelligence and adaptive technologies to allow real-time personalisation depending on the Nigerian curriculum (De Simone *et al.,* 2025; Abubakar *et al.,* 2024; Yakubu *et al.*, 2025). In practice, they presuppose cost-efficient interventions. In the case of educators, improved interaction implies that AI would be used as an addition to conventional instruction, and it may translate into fewer workload. More comprehensive society-wide implication is that digital skills to workforce readiness must be considered, at the cost of equally managing and addressing more ethical issues such as data privacy (Akintola *et al.,* 2025; Alonso *et al*., 2025; Ayeni *et al.,* 2024; Bali *et al.,* 2024; Capinding and Dumayas, 2025; Oloyede, 2025).

4.0 CONCLUSION

This study concludes that adaptive learning systems based on AI can be useful in improving the individual approach to education in Nigeria. The results indicate significant student gains in the academic performance reported in the study as academic improvement in English of 0.24 SD and mathematics took place at 0.35 SD stressing the ability of adaptive AI tools to personalise the academic learning process and improve student achievement in comparison to more traditional instructional tools. Furthermore, favourable impressions and interactions by the user imply that AI has the ability to bring in yet learner driven motivation and independence, by providing them with targeted feedback at their pace. But the continued presence of infrastructural barriers, digital divide, and privacy issues points to a necessity to have systemic preparedness and policy assistance to attain all the benefits.

In the education sector of Nigeria, the adaption of AI systems involves the purchase of digital infrastructure, educational resources, and a system design considering the local curriculum and language diversity. On the same note, strong governance policies are necessary to protect data privacy in the name of privacy, ethical AI application in schools. The study limitation includes first, the sample size (n = 200) and the focus on four schools in Abuja and Lagos restricts the generalisation of results to the entire

Nigerian secondary school's context. Second, infrastructure issues including poor internet connectivity and power outage impacted on system workability and us experience. Third, the brief time span of th quasi-experiment intervention could fail to realise long-term learning outcomes or behavioural experiences. Lastly, the use of self-reported engagement and satisfaction data may lead to bias with regard to the response, and the nature of AI tools may influence replicability in future research due to change over time.

Further studies should investigate the effects of adaptive learning using AI over extended durations in terms of knowledge retention and critical thinking and academic equity over long periods. It is also suggested that comparative research in rural and urban location gives the identification of the contextual determinants of adoption. Moreover, sustainable, equitable, and scalable implementation of localised AI models by educators, learners, and policymakers will require co-design as a pillar in the education sector using Nigeria as a case study.

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