

INFLUENCE OF ARTIFICIAL INTELLIGENCE COMPUTERIZED MULTIPLE CHOICE ADAPTIVE ACHIEVEMENT TEST (AI-CAT) ON ACADEMIC PERFORMANCE OF UNDERGRADUATES IN LAGOS STATE UNIVERSITY OF EDUCATION, LAGOS STATE, NIGERIA

¹IBEREDEM, T. I. Ph.D.; & ²UDOFIA, I. G. Ph.D

¹Department of Guidance and Counselling, Ambrose Alli University, Ekpoma, Edo State

Email: ¹tessyonotse@aauekpoma.edu.ng; & ²udofiaig@lasued.edu.ng

¹08066453562

&

²Department of Guidance and Counselling, College of Specialized and Professionalized Education, Lagos State University of Education, Lagos State

Abstract

This study examined how use of Artificial Intelligence Computerized Multiple Choice Adaptive Achievement Test (AI-CMCAAT) influenced undergraduates' performance in Lagos State University of Education, Lagos State, Nigeria. Two hypotheses were formed in the study. Quasi-experimental research design using a pretest-posttest control group experimental design was adopted. The population comprised of 2,345 third year undergraduate students in Lagos State University of Education. One tenth of the population was used and a sample of 285 undergraduates was obtained using multi-stage sampling procedure. Data was collected using AI-CMCAAT from seven selected topics on Educational Measurement and Evaluation. The instrument contained 35 items using four-options response format. The validity of the test was determined by three experts in the field of Measurement and Evaluation. Cronbach's alpha reliability was used to determine internal consistency of items which yielded a coefficient $r=.779$. Independent sample t-test was used to analyze the data as hypotheses were tested at .05 level of significance. The findings revealed that the performance of students generally was not as significant as expected to compliment previous studies. It also discovered that although AI generated scale provides personalized assessment, immediate feedback, and improved test precision, the conventional test (Teacher Made Test) is perceived to be more learner friendly, relate learners learning condition and time, factor ability level of students in the course of test development among others. The authors concluded that while AI adaptive tests remains an effective assessment innovation capable of improving students' academic performance in school, teachers need be trained on the globally accepted structured format needed to formulate test items especially in this era of digital space. It recommended that educational stakeholders should complement adapting AI adaptive tests in classrooms in other to enhance better learning outcome.

Keywords: Academic Performance, Artificial Intelligence, Computerized Adaptive Technique, Multiple Choice Test, Undergraduates

Introduction

The emergence of Artificial Intelligence (AI) has sparked innovations and enhanced efficiency as one of the most innovative technologies in contemporary higher education, thereby reshaping instructional delivery, learning support and educational assessment. Due to the numerous positives, AI is highly embraced across all fields of human endeavours and education is not an exemption. The integration of AI into assessment practices has moved beyond conventional computer-based testing to intelligent systems capable of adapting to the ability level of individual learners (Fasinro et al., 2024). One of the most innovative applications of AI in educational measurement is the Artificial Intelligence Computerized Multiple Choice Adaptive Achievement Test (AI-CAT), which dynamically selects test items based on a student's responses, thereby providing a more precise estimate of academic ability. Unlike the traditional paper-and-pencil examination where all students answer identical questions irrespective of their competence, AI-CAT presents items that

match each learner's ability level, minimizes item exposure, shortens testing time, and improves measurement accuracy. These capabilities align with global trends toward personalized learning and competency-based assessment, making AI-CAT increasingly relevant for improving learning outcomes in higher education (Abubakar et al., 2024).

The increasing adoption of AI technologies within Nigerian higher education has created new opportunities for improving teaching, learning, and assessment. Nigerian universities and other tertiary institutions are gradually integrating AI-supported instructional platforms, intelligent tutoring systems, learning analytics, and digital assessment technologies to enhance educational quality. Studies conducted by Fasinro et al, (2024), Peters and Olojede (2025) in Nigerian universities indicated that undergraduate students generally perceive AI-supported learning environments as beneficial because they provide immediate feedback, personalized learning pathways, and greater academic engagement. Similarly, Tijani and Adeduyigbe (2026) argued that AI has the potential to improve assessment validity by reducing human errors, increasing objectivity, and providing real-time performance analytics for educators. These developments suggest that AI-driven adaptive assessment systems could significantly improve the quality of measurement of students' academic achievement or performance in tertiary institutions across Lagos State.

Academic performance remains one of the most important indicators of educational quality in higher education because it reflects the extent to which students have achieved expected learning outcomes. In Nigerian tertiary institutions, assessment largely determines students' progression, graduation, scholarship opportunities, and employability (Federal Republic of Nigeria (FRN), 2013). However, conventional multiple-choice achievement tests frequently suffer from several limitations, including the administration of identical test items to students with varying ability levels, prolonged testing duration, item redundancy, examination fatigue, and reduced measurement precision. These challenges may produce inaccurate estimates of students' actual abilities, particularly among highly talented or academically weak learners. AI-CAT addresses these shortcomings by employing adaptive algorithms that continuously estimate student ability and administer questions appropriate to each individual's competence level, thereby improving both efficiency and precision of assessment. Such innovations are particularly important in large university systems where student populations continue to expand while maintaining the demand for reliable and valid assessment practices.

Within Lagos State, which hosts some of Nigeria's largest federal, state, and private tertiary institutions, the need for innovative assessment approaches has become increasingly evident. The state serves as Nigeria's educational and technological hub, with public and private institutions experiences rapid digital transformation. The increasing availability of digital infrastructure, internet connectivity, and AI-enabled educational technologies provides favourable conditions for implementing AI-CAT. Nevertheless, despite growing investments in educational technology, assessment practices in many institutions remain predominantly dependent on conventional multiple-choice examinations that offer limited personalization and delayed feedback. There is a growing need to examine whether AI-assisted adaptive achievement testing can significantly improve undergraduate students' academic performance within the confines of Lagos State institutions.

The theoretical justification for AI-CAT is rooted in modern educational measurement, particularly Item Response Theory (IRT), which emphasizes estimating examinees' latent abilities through mathematically calibrated test items. AI enhances the adaptive testing process by employing intelligent algorithms that continuously update ability estimates after each response, select optimally informative items, and terminate testing once sufficient measurement precision is achieved. Moreso, Peters and Olojede (2025) noted that AI-CAT provides individualized assessment experiences while maintaining high reliability and validity. Furthermore, adaptive testing reduces test anxiety associated with excessively difficult or excessively easy examinations because students receive questions aligned with their demonstrated competence. The immediate scoring and diagnostic feedback generated by AI-CAT also enable lecturers to identify learning

gaps promptly and design targeted instructional interventions that enhance students' academic performance. These characteristics position AI-CAT as an important innovation for evidence-based assessment and continuous quality improvement in higher education.

With the growing interest in AI applications in Nigerian education, past studies have focused predominantly on AI-assisted learning, generative AI, students' perceptions of AI technologies, and ethical considerations surrounding AI adoption, while relatively little attention has been devoted to AI-enabled computerized adaptive achievement testing and its direct influence on undergraduate students' academic performance. Existing Nigerian studies have rarely investigated AI-CAT as an assessment innovation within tertiary institutions, particularly in Lagos State where digital readiness is comparatively high. The gap in the study limits policymakers, university administrators, lecturers, and educational technologists in making informed decisions regarding the adoption of adaptive assessment technologies. Therefore, this study seeks to investigate the influence of AI-CAT on the academic performance of undergraduates in Lagos State institutions, with the expectation that the findings will contribute to educational assessment, technology integration, and policy formulation aimed at improving learning outcomes in Nigerian higher education.

Statement of the Problem

Just like every other mathematics related courses in universities, the academic performance of undergraduates in educational measurement and evaluation has also experienced some degree of setback as it derived performance has not really met the required baseline expected by those who teach the course. Possible factors that may be associated with the decline in undergraduates' performance could be attributed to low latent ability, poor knowledge of mathematics, phobia for failure, inadequate and irrelevant instructional materials, poor timing, poor reading ability, lack of motivation among others. As part of effort to improve the quality of assessment in higher education, the academic performance of many undergraduates remains inconsistent, with concerns about the effectiveness, fairness and diagnostic value of teacher made based multiple-choice achievement tests. Traditional assessment (use of Teacher Made Multiple Choice Measurement and Evaluation Achievement Test) often present identical test items to all students regardless of their ability levels, thereby increasing the likelihood of item mismatch, test anxiety, guessing, and measurement errors that may not accurately reflect students' true academic abilities. The emergence of AI-CAT offers an innovative assessment approach that dynamically adjusts the difficulty of test items based on students' responses, thereby providing more precise measurement, immediate feedback, and enhanced testing efficiency. Although AI-driven adaptive testing have gained increasing global acceptance, research on its effectiveness in improving the academic performance of undergraduates within higher institutions, particularly in Lagos State, remains limited. It is unclear whether AI-CAT significantly enhances students' academic performance as compared with the traditional assessment methods. This lacuna in researched knowledge creates uncertainty for lecturers, educational administrators, and policymakers regarding the adoption of AI-based assessment technologies in tertiary institutions. It is against this background that this study investigated the influence of AI-CAT on the academic performance of undergraduates in Lagos State University of Education.

Purpose of the Study

The study of the study was to investigate the influence of AI-CAT on academic performance of undergraduates in Lagos State University of Education. Specifically the aim of the study was to examine:

1. the difference in students' posttest score in AI-CAT by experimental and control group; and
2. the difference in students' posttest academic performance in TMMCMEAT by experimental and control group.

Research Questions

Two research questions were raised from the study and they include:

1. **What is the** difference in students' posttest score in AI-CAT by experimental and control group?
2. .What is the difference in students' posttest academic performance in TMMCMEAT by experimental and control group?

Methods

The true-experimental research design using Pretest-Posttest control group experimental design was adopted. The design allows for randomization of participants into experimental and control groups. The experimental groups were exposed to treatment condition that is AI-CAT and TMMCMEAT strategies and the control group was exposed to advise that is Advisory Service. The experimental groups were exposed to structured teaching on M &E for four weeks of an hour each for four weeks. Each of those one hour was used to cover a minimum of one topic from the course outline accounting for the teaching of seven topics in four weeks.

Fig. 1: Solomon IV Pretest Posttest control group experimental research design is expressed below:

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R₁: 0₁₁ X₁ 0₁₂ Experimental group (AI-CAT)
 R₂: 0₂₁ //// 0₂₂ Control group
 R₃: X₂ 0₃₂ Experimental group (TMMCMEAT)
 R₄: 0₄₂ Control group

Source: Kerlinger and Lee (2002)

- Where R is randomization;
- X₁ and X₂ are interventions;
- //// is Dummy item
- 0₁₁ & 0₂₁ is Pre-test scores
- 0₁₂, 22, 32 & 0₄₂ as post-test scores.

The population consisted of 2345 third year (300 level) undergraduate students in Lagos State University of Education. One tenth of the population was used and a sample of 285 undergraduates was obtained using multi-stage sampling procedure. Data was collected using AI-assisted Computerized Multiple Choice Adaptive Achievement Test (AI-CMCAAT), from seven selected topics on Educational Measurement and Evaluation. The instrument contained 35 items using four-points response format. The validity of the test was determined by three experts in the field of measurement and evaluation. Cronbach's alpha reliability was performed which yielded a coefficient $r=.779$. Independent sample t-test was used to analyze the data as hypotheses was tested at .05 level of significant.

Results

Hypothesis 1: There is a significant Posttest difference in students' academic performance in AI-CAT by experimental and control group.

Table 1

Independent t-test Analysis' showing Significant Posttest difference in Students' Academic Performance in AI-CAT by Experimental and Control Group.

Groups	N	Mean	SD	Df	t	Sig.	Decision
Experimental	35	2.59	.59	133	2.40	.019	Reject H ₀₁
Control	100	2.76	.71				
Total	135						

N= 135, SD= .59, .71; df= 133; Sig= .019

Table 1 shows that participants in the control group are more than the experimental group however the mean and standard deviation values in the control group is higher than that of experimental group. The output also shows that t-calculated value is 2.40 as Sig. level at .019 respectively. Since $p < .05$, the null hypothesis is rejected and the alternative which states there is a significant posttest difference in students' academic performance in AI-CAT by experimental and control group is retained.

Hypothesis 2: There is a significant posttest difference in students' academic performance in TMMCMEAT by experimental and control group.

Table 2

Independent Sample t-test Analysis showing Significant Posttest difference in Students' Academic Performance in TMMCMEAT by Experimental and Control Group

Groups	N	Mean	SD	Df	t	Sig.	Decision
Experimental	35	4.36	.87	148	3.47	.000	Reject H ₀₂
Control	115	2.94	.58				
Total	150						

N= 150; SD= .87, .58; df= 148; Sig= .000

Table 2 showed that participants in the control group are more than the ones in experimental group however the mean and standard deviation in the experimental group exceed those in control group. The output also shows that t-calculated value is 3.47 as Sig. level at .000 respectively. Since $p < .05$, the null hypothesis is rejected and the alternative which states that there is a significant posttest difference in students' academic performance in experimental and control group is retained.

Discussion of Findings

The result from hypothesis one shows that students in the control group outperform those in the experimental group as seen in their post-test scores. This implies that the introduction of AI-based adaptive testing in educational measurement and evaluation did not automatically translate into improved academic achievement for the experimental participants. Such an outcome may be attributed to factors including students' unfamiliarity with adaptive testing procedures, inadequate digital literacy, test anxiety associated with AI-driven assessment, unstable technological infrastructure, or insufficient orientation before exposure to the adaptive testing environment. Students in the control group, who may have completed the assessment under more familiar or conventional testing conditions, were less likely to experience the cognitive overload associated with navigating a new assessment technology, thereby demonstrating superior performance. This finding aligns with that of Abubakar et al. (2024), Alabi et al. (2025) who claimed that the effectiveness of AI use in education depends not merely on the availability of intelligent technologies but also on learners' readiness, teachers' competence, institutional support, and adequate digital infrastructure. Meanwhile Ukozor (2025) argued that while artificial intelligence has considerable potential to improve assessment and learning outcomes, its benefits may not be fully realized where implementation challenges, limited technological skills, inadequate training, and infrastructural deficiencies persist. The superior performance of the control group underscores the importance of systematic preparation, digital literacy training, and gradual integration of AI-

based assessment systems before expecting measurable improvements in students' academic performance.

Data from hypothesis two shows that there is a significant post-test difference in students' academic performance in Teacher Made Multiple Choice Measurement and Evaluation Achievement Test by experimental and control group. It reveals that students in experimental group performed better than their counterparts in the control group especially when exposed to Teacher-Made Multiple Choice Measurement and Evaluation Achievement Test. This indicates that the instructional intervention or teachings produced superior learning outcomes beyond those achievable through conventional classroom instruction. This implies that students exposure to quality instruction enhanced students' understanding of measurement and evaluation concepts, improved test-taking competence and promoted deeper cognitive engagement with the course content. The superior performance of the experimental group is consistent with constructivist learning principles, which posit that learners achieve higher academic outcomes when actively engaged in meaningful and learner-centred instructional activities. The outcome corroborates with that of Abanobi (2022) who established that learners exposed to timely content and information are bound to outperform those not exposed to same content at intervals. Meanwhile Uka et al. (2026) reported that students who received AI-supported instructional interventions achieved significantly higher scores on a teacher-made achievement test than students in the control group, highlighting the effectiveness of technology-enhanced instructional approaches in improving learning outcomes. The findings revealed that the performance of students generally was not as significant as expected to compliment previous studies. It also discovered that although AI generated scale provides personalized assessment, immediate feedback, and improved test precision, the conventional test (Teacher Made Test, TMT) is perceived to be more learner friendly, relate learners learning condition and time, factor ability level of students in the course of test development among others. It concluded that while AI adaptive tests remains an effective assessment innovation capable of improving students' academic performance in school, teachers need be trained on the globally accepted structured format needed to formulate test items especially in this era of digital space.

Conclusion and Recommendations

From the findings made in the study, the researchers concluded that effectiveness of AI use in education depends not merely on the availability of intelligent technologies but on learners' readiness, teachers' competence, institutional support, and adequate digital infrastructure. It also concluded that students in experimental group performed better than their counterparts in the control group especially when exposed to Teacher-Made Multiple Choice Measurement and Evaluation Achievement Test. This suffices that instructional intervention or teachings produced superior learning outcomes beyond those achievable through conventional classroom instruction.

The following recommendations were made:

1. Educational stakeholders should endeavor to complement adapting AI adaptive tests in classrooms in other to enhance better learning outcome.
2. AI generated test items should be validated by experts in the field of study in other to remove items that discriminate among learners geographically
3. Students should be multi-tasked occasionally in classroom activities in other to improve quality reasoning and logical presentation of content rather than depending solely on AI use.

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