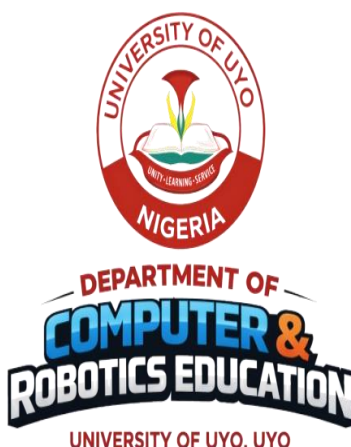




21st Century Technology Education: Artificial Intelligence in Classroom Teaching and Students' Academic Performance in Senior Secondary Schools in South East, Nigeria

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ABSTRACT

This study focused on “21st century technology education: Artificial intelligence in classroom teaching and students' academic performance in senior secondary schools in south East, Nigeria”. The application of AI to classroom instruction has demonstrated considerable potential for advancing educational equity and improving instructional efficiency. The application of artificial intelligence (AI) in education has expanded significantly in recent years, reshaping teaching, learning and educational management processes. Two objectives and two research questions were raised to support the study. This study employed a co-relational survey research design. The population of the study comprised 2000 students and 200 teachers. The researchers sampled 192 students and 8 teachers using samples random sampling by balloting techniques. The instrument used data collection was Artificial Intelligence in Classroom Teaching and Students' Academic Performance (AICTSAP). AICTSAP questionnaire was validated by two experts and test-tried on 30 students who were not part of the main study and a reliability coefficient of 0.98 was obtained. Research questions were answered using mean statistics via SPSS which revealed the grand mean of 2.54 which implies that teachers generally accepted the utilization of AI in classroom instruction. Also, the grand mean of 2.65 confirmed that teachers generally accepted the availability and use





of AI-related devices and facilities in schools. Furthermore, it was recommended that government should provide AI software for classroom teaching and learning to reduce difficulty in learning.

Keywords: *21 Century Technology Education, AI, Classroom, Teaching, academic performance*

INTRODUCTION

Artificial intelligence (AI) is a multidisciplinary scientific field concerned with the development of theories, methods and technological systems that replicate, augment and extend human cognitive capacities. Within educational contexts, the application of AI to classroom instruction has demonstrated considerable potential for advancing educational equity and improving instructional efficiency. As AI becomes more deeply embedded in teaching and learning processes, notable trends are emerging including the possible restructuring of traditional Schooling systems, increased parental involvement in learning supervision, the gradual erosion of conventional pedagogical norms, shifts in the distribution of educational costs, the rise of highly personalized instructional resources and persistent concerns regarding the limited support for learners' socio-emotional development (Bao, 2019; Selwyn, 2023).

Across all levels of education, the digital transformation driven by twenty-first-century technological advancements has significantly reshaped teaching and learning practices. Luckin, (2024) reported that these innovations, artificial intelligence stands out as one of the most transformative forces influencing contemporary education systems worldwide. AI in education leverages techniques such as machine learning, natural language processing, and learning analytics to support adaptive instruction, enhance learning experiences, and improve educational outcomes. As modern economies increasingly prioritize knowledge, digital competence and technological literacy, AI has become a central component of innovative pedagogical strategies designed to prepare learners for complex, technology-driven societies (Holmes, Luckin and Selwyn, 2022)

Furthermore, according to Bialik, Holmes and Fadel (2022), AI-based educational technologies are progressively being adopted to personalize learning pathways, automate routine instructional tasks, and increase student engagement. These tools can analyze learner data to customize instructional content, deliver timely, individualized feedback and provide intelligent tutoring support, while also reducing teachers' administrative workload through automated grading, assessment and lesson planning. Consequently, AI holds promise for enabling educators to focus more on higher-order teaching activities and meaningful interactions with learners (Zhai, Chu, Chai, Jong, Istenic, Spector and Wang 2024).

Stefan (2017) noted that the combination of artificial intelligence and education puts the present schools education gap behind and schools in the traditional sense faces abolishment. Schools in the traditional sense support a one-size-fits-all curriculum and teaching all students at





a fixed speed does not meet the needs of the times. Artificial intelligence system in teaching allows customized courses according to the students' own situation, flexible learning time as well as reducing the demand for the number of classrooms and teachers. Therefore, the scale of traditional schools becomes smaller and smaller whereas most schools faces elimination, while some of the innovative and reformed evolves into small-scale learning centers, adopting one-to-one teaching mode or becoming specialized learning centers. Artificial intelligence comprehensively changes the traditional schools teaching materials, that is, taking a new form of teaching materials. The artificial intelligence system uses the teaching syllabus formulated by the teacher to make personal teaching materials based on the individual differences of students or reassembles a theme textbook based on a theme or learning link in the teacher's teaching syllabus and combines it with the database content. The newly customized and thematic materials are more tailored to the needs of specific learners and thus serve the teaching process better (Stefan, 2017).

The Application of Artificial Intelligence in Classroom Teaching

The application of artificial intelligence (AI) in education has expanded significantly in recent years, reshaping teaching, learning and educational management processes. One of the most prominent applications is the use of intelligent tutoring systems (ITS), which are designed to provide personalized instruction and immediate feedback tailored to individual learners' needs. These systems adapt instructional strategies based on learners' responses, learning pace and performance patterns, thereby supporting mastery learning and reducing achievement gaps among students (Holmes et al., 2022; Zhai et al., 2024).

Another important application of AI in education is the use of automated assessment and grading. Luckin (2024) documented that AI-powered assessment tools can efficiently evaluate tests, assignments and even open-ended responses using machine learning and natural language processing techniques. This not only reduces teachers' workload but also ensures faster feedback for students, which is critical for learning improvement. Automated assessment systems enhance consistency and objectivity in grading while allowing educators to devote more time to instructional planning and learner support (Bialiket et al., 2022).

Adaptive learning platforms also represent a major area of AI application in education. These platforms dynamically adjust the level of difficulty, instructional content and learning pathways based on students' academic performance and engagement data. By continuously analyzing learners' progress, adaptive systems support differentiated instruction and personalized learning experiences which have been shown to improve motivation, retention and academic outcomes across diverse learning contexts (Holmes et al., 2022; Selwyn, 2023).

In addition, AI-driven chatbots and virtual assistants are increasingly used in educational institutions to support both teaching and administrative functions. These tools can respond to





students' questions, provide guidance on course materials, assist with registration processes alongoffer reminders about assignments deadlinesand so on. By automating routine interactions, chatbots enhance communication efficiency and improve students' access to academic support, particularly in large or online learning environments (Zawacki-Richter, Marín, Bond and Gouverneur, 2019; Zhaiet al., 2024).

Predictive analytics is another critical application of AI in education, enabling institutions to identify students who may be at risk of academic failure or disengagement. By analyzing large datasets that include attendance records, assessment scores and learning behaviors, AI systems can forecast potential learning difficulties and recommend timely interventions. Holmes et al. (2022) emphasize that such data-driven insights support early intervention strategies and individualized learning pathways, ultimately enhancing learner outcomes and institutional effectiveness. In overall, the applications of AI in education demonstrate its potential to transform instructional delivery, assessment practices, learner support systems and educational decision-making.

Statement of the Problem

In the 21st century, the integration of Artificial Intelligence (AI) into classroom teaching has occurred as a significant innovation in education, hopeful to transform learning through personalization, automation and intelligent feedback. Although, its growing presence abound, many educational institutions especially in developing regions are still struggling to successfully implement AI technologies due to issues such as insufficient infrastructure, lack of teacher training, ethical concerns, and resistance to technological change.

Objectives of the Study

The objective of the study focused on 21st Century Technology Education: Classroom teaching in Senior Secondary in South East, Nigeria. Specifically, the study sought to:

1. determine how an AI technology utilization influence teachers' classroom delivery and students' academic performance in senior secondary schools in South East, Nigeria
2. determine how teachers' attitude influence classroom teaching and students'academic performance in senior secondary schools in South East, Nigeria.

Research Questions

The following research questions were raised to guide the study.

1. What influence does an AI technology utilization have on teachers' classroom delivery and students' academic performance in senior secondary schools in South East, Nigeria?
2. What influence does teachers' attitude have on classroom teaching and students' academic performance in senior secondary schools in South East, Nigeria?





METHODOLOGY

This study employed a co-relational survey research design which is the plan of study that enables researchers to use reliable techniques to collect data from a well-defined population or systematically selected segments of the population (Akanwa and Clementina, 2018). This is good for the study because it helped to identify the characteristics of the population. The population of the study comprised 2000 students and 200 teachers. The researchers sampled 192 students and 8 teachers using samples random sampling by balloting techniques. At first, 4 Schools were purposively selected from South East (Abia and Imo states).

The instrument used data collection was Artificial Intelligence In Classroom Teaching and Students' Academic Performance (AICTSAP). AICTSAP questionnaire was validated by two experts. This study used 4 rating scales with 4 points of strongly disagree to strongly agree. The reliability of the instrument was determined by using the Cronbach's alpha statistics with the aid of statistical package for social sciences (SPSS) and the result showed a reliability coefficient of 0.98 which is higher than the benchmark of 0.7. The researchers administered 200 copies of the questionnaires and retrieved 150 copies represented by 75% return rate. The data collected for this study were analyzed with descriptive statistics using SPSS.

RESULTS

Research Question One: What influence does AI technology utilization have on teachers' classroom delivery and students' academic performance in senior secondary schools in South East, Nigeria?

Table 1: Mean response of AI technology utilization of teachers' classroom delivery and students' academic performance in senior secondary schools

S/N	Item Statements	Mean	Remark
1.	AI backs up teachers' responsibility in the classroom	2.58	Accepted
2.	AI improves educational efficiency	2.51	Accepted
3.	AI weak traditional norms in the Schools	2.50	Accepted
4.	AI enhance the efficacy of instruction	2.58	Accepted
Grand mean		2.54	Accepted

Number of respondents sampled = 150, Average mean value= 2.50.

Table 1 indicated that teachers generally hold a positive perception of the role of artificial intelligence (AI) in classroom instruction. The item "AI backs up teachers' responsibility in the classroom" and "AI enhance the efficacy of instruction" recorded mean scores of 2.58, which was accepted, suggesting that respondents agree that AI supports instructional responsibilities rather than replacing teachers. This implies that AI is viewed as a complementary tool that enhances





teaching effectiveness. Similarly, the statement “AI improves educational efficiency” yielded a mean score of 2.51, indicating acceptance. This finding suggested that teachers perceive AI as contributing to improved efficiency in lesson delivery, assessment and classroom management. The item “AI weakens traditional norms in schools” recorded an accepted mean of 2.50, implying that respondents acknowledge AI’s influence on transforming conventional teaching practices, though not necessarily in a negative manner. Furthermore, the grand mean of 2.54, which exceeds the decision benchmark, confirmed that teachers generally accepted the utilization of AI in classroom instruction.

Research Question Two: What influence does teachers’ attitude have on classroom teaching and students’ academic performance in senior secondary schools in South East, Nigeria?

Table 2: Mean response of teachers’ attitude in classroom teaching and students’ academic Performance in senior secondary schools

S/N	Item Statements	Mean	Remark
1.	Teachers’ feels happy using many AI packages needed for teaching and learning	2.50	Accepted
2.	Teachers’ dislike being provided with needed AI packages for learning in the schools	2.51	Accepted
3.	Teachers are equipped with many devices needed for students’ academic outcome in the schools	3.08	Accepted
4.	Teachers are equipped with online facilities to ease students’ participation in classrooms	2.53	Accepted
Grand mean		2.65	Accepted

Note: Number of respondents sampled = 150, Average mean value= 2.50.

Table 2 examined teachers’ attitudes toward AI usage and the availability of AI-related facilities in schools. The item “Teachers feel happy using many AI packages needed for teaching and learning” recorded a mean score of 2.50, which was accepted. This indicated a acceptable level of satisfaction among teachers regarding the use of AI tools in instructional activities. The “Teachers dislike being provided with needed AI packages for learning in the schools” also recorded a mean score of 2.51 and was accepted. The acceptance resulted in a mixed feelings or possible resistance among some teachers, which may be attributed to inadequate training, fear of technology or increased workload associated with AI usage. The item “Teachers are equipped with many devices needed for students’ academic outcome in the schools” recorded a relatively higher mean score of 3.08, indicating strong acceptance. This suggested that respondents acknowledge





the availability of digital devices that can support students' academic performance. Likewise, "Teachers are equipped with online facilities to ease students' participation in classrooms" which recorded an accepted mean score of 2.53, implying that online facilities moderately support classroom interaction and participation. The grand mean of 2.65 confirmed that teachers generally accepted the availability and use of AI-related devices and facilities in schools.

CONCLUSION

AI offers the potential to transform education in the twenty-first century. Artificial intelligence in classroom teaching plays a positive role in promoting educational fairness and improving educational efficiency. Besides, it also makes the presentation of teaching content more suitable for the cognitive characteristics of students and enhances students' understanding and mastery of the content of textbooks.

RECOMMENDATION

1. Government should provide AI software for classroom teaching and learning to reduce difficulty in learning,
2. Government should provide AI-based tools that will enhance students' engagement and their academic results.

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