

ASSESSMENT OF AI-ASSISTED INSTRUCTIONAL STRATEGIES AND ACADEMIC
PERFORMANCE OF PRIMARY SCHOOL PUPILS IN UYO METROPOLIS

By

Okon EKAEBBA
Department of Primary Education
Akwa Ibom State College of Education,
Afaha Nsit.
Nigeria

Isaac SAM,

And

Dr Arit ATAKPA
Department of Early Childhood Education
Akwa Ibom State College of Education
Afaha Nsit.
Nigeria

ABSTRACT

*This study assessed artificial intelligence (AI)-assisted instructional strategies and the academic performance of primary school pupils in Uyo Metropolis, Nigeria. In carrying out the study, descriptive survey design was adopted. The study was carried out in Uyo Metropolis. The targeted population for the study comprised all the primary school pupils in Uyo Metropolis. A simple random sampling technique was used to select a total of 100 respondents used for the study. The instrument used for data collection was a structured questionnaire titled, "AI-Assisted Instructional Strategies and Academic Performance of Primary School Pupils Questionnaire (AISAPPSPQ)". Face and content validation of the instrument was carried out by an expert in test, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration. The reliability coefficient obtained was 0.85, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical technique such descriptive statistics to answer research questions. The study showed that the highest percentage of respondents indicated that the extent of using AI-assisted instructional strategies in primary schools is **very low (VLE)**. The result also proved that the most prominent role of AI-assisted instructional strategies in effective learning in primary school is Personalization and Adaptive Instruction. On this basis it was concluded that the assessment of AI-assisted instructional strategies shows that these tools significantly enhance primary school pupils' understanding and engagement in Uyo Metropolis. AI applications provide personalized learning experiences that support*

individual learning needs and improve academic performance. One of the recommendations made was that government and school administrators should supply reliable electricity, internet access and functional digital devices to support effective AI-assisted teaching.

KEYWORD: Artificial Intelligence (AI), Instructional Strategies, Academic Performance, Primary School Pupils, Uyo Metropolis

INTRODUCTION

In an era marked by rapid technological evolution, the integration of artificial intelligence (AI) into instructional strategies presents a promising frontier for enhancing teaching and learning processes. Traditional pedagogies largely teacher-centred and uniform in pace are increasingly challenged by the diversity of learners, demands for individualized instruction, and evolving global competencies. Within this context, AI-assisted instructional strategies are gaining traction as tools capable of tailoring learning experiences, providing real-time feedback, and enabling adaptive pacing that aligns with each learner's needs. Indeed, recent systematic reviews have documented a variety of applications of AI in education: from intelligent tutoring systems, and generative tools, to automated feedback systems and analytics-driven content delivery. For example, one review emphasized five types of AI applications supporting teaching practice, categorizing technological characteristics and pedagogical roles. In primary school settings, investigations into AI literacy education reveal that children engaged with AI-infused tasks (project-based, programming, human-agent interaction) exhibited positive academic outcomes, including improved knowledge acquisition, higher engagement and more consistent performance, (Lee, 2024).

Thus, this study sets out to assess the relationship between the implementation of AI-assisted instructional strategies and the academic performance of primary school pupils in Uyo Metropolis. Specifically, it seeks to examine how such strategies are being adopted, the extent to which they influence pupil achievement, and what factors moderate this relationship (such as teacher readiness, technology infrastructure and pupil engagement). The findings will contribute to the body of knowledge on the efficacy of AI in the early years of schooling in Nigeria and provide empirical evidence for policy-makers, school administrators and teachers planning to integrate AI technologies in teaching-learning processes.

STATEMENT OF PROBLEM

Despite the growing use of artificial intelligence (AI) in education, primary schools in Uyo Metropolis continue to record varying levels of pupils' academic performance. Conventional teaching methods still dominate classroom instruction, often limiting personalized learning and active pupil engagement. AI-assisted instructional strategies are designed to enhance learning through individualized support and interactive content, yet their level of implementation in Uyo primary schools remains uncertain. Inadequate digital

facilities and limited teacher competence affects the effectiveness of AI-assisted instruction. Consequently, stakeholders lack reliable information to guide policy and instructional decisions. This study therefore seeks to assess AI-assisted instructional strategies and their relationship with the academic performance of primary school pupils in Uyo Metropolis.

RESEARCH OBJECTIVE

1. To Find out the extent of using AI-Assisted instructional strategies for effective learning in primary schools
2. To find out the roles of AI-Assisted Instructional Strategies in effective learning in primary schools

RESEARCH QUESTION

1. What is the extent of using AI-assisted instructional strategies for effective learning in primary schools?
2. What are the roles of AI-assisted instructional strategies in effective learning in primary schools?

LITERATURE REVIEW

Concept of AI

Artificial intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. AI is revolutionizing the way learning materials are distributed and utilized in secondary schools. Digital learning platforms powered by AI can suggest personalized learning resources to students based on their strengths and weaknesses. AI-based learning resource management systems enable schools to track textbook usage, predict future resource needs, and prevent shortages. AI-powered analytics systems can track student performance and provide early warnings about potential academic struggles. These systems use data from tests, attendance records, and behavioral patterns to suggest interventions (Akpan & Essien, 2025).

According to Clark & Akpan (2025), Artificial intelligence (AI) is a technology that allows computers to perform tasks that typically require human intelligence. AI systems can learn from experience, adjust to new inputs, and improve over time. The goal of artificial intelligence is to enhance computer abilities related to human understanding, including language intelligence, learning, reasoning, and problem-solving.

According to Yetunde, Udoh et al (2025), integrating Artificial Intelligence (AI) into building design has emerged as a transformative approach to enhance efficiency, sustainability, and innovation in architecture. Implementing AI techniques, such as machine learning algorithms, can optimize building designs to achieve sustainability goals. Surrogate models, for instance, enable rapid evaluation of design alternatives, facilitating energy efficiency and environmental performance enhancements.

CONCEPT OF AI-ASSISTED INSTRUCTIONAL STRATEGIES

AI-Assisted Instructional Strategies refer to the application of artificial intelligence (AI) technologies in teaching and learning processes to enhance instruction, engagement, and learning outcomes. According to Li and Wang (2020), AI-assisted instruction utilizes intelligent systems capable of analyzing learners' behaviors, predicting their needs, and providing adaptive feedback. These systems employ algorithms and data analytics to personalize instruction based on each learner's strengths and weaknesses. The primary goal is to make learning more efficient, interactive, and student-centered.

AI-assisted instructional strategies rely on tools such as intelligent tutoring systems, adaptive learning platforms, and chatbots that simulate one-on-one tutoring. As explained by Chen et al. (2021), these technologies allow teachers to automate routine instructional tasks such as grading and assessment while providing students with instant feedback. This supports differentiated learning and encourages students to take ownership of their learning experiences. Through these systems, learning becomes dynamic rather than static, aligning with each learner's pace and style.

Another important aspect of AI-assisted instructional strategies is the integration of data-driven insights into lesson planning and decision-making. According to Al-Marouf and Al-Emran (2018), AI tools analyze vast amounts of educational data to help instructors identify knowledge gaps, predict academic performance, and tailor interventions for struggling students. This approach fosters inclusivity and equity by ensuring that all learners receive appropriate attention and support. Teachers, in turn, become facilitators who guide students using AI-generated insights.

TYPES OF AI-ASSISTED INSTRUCTIONAL STRATEGIES

Artificial Intelligence (AI) has become an integral component of modern education, transforming how teachers teach and how students learn. AI-assisted instructional strategies utilize intelligent algorithms, data analytics, and automation to enhance the learning experience, promote engagement, and improve academic outcomes. The following sections discuss the major types of AI-assisted instructional strategies currently applied in educational contexts.

➤ **Personalized Learning**

Personalized learning is one of the most significant applications of AI in education. It uses machine learning algorithms to tailor instruction, learning pace, and materials to each learner's needs and preferences (Nouri et al., 2022). AI systems continuously analyze learner data, including assessment results, behaviour patterns, and content interactions, to deliver customized learning experiences. Platforms such as *Dream Box* and *Knewton Alta* use adaptive technologies to adjust lesson difficulty dynamically.

➤ **Automated Feedback and Assessment**

AI-powered feedback and assessment tools employ natural language processing (NLP) and predictive analytics to evaluate student work and provide instant, constructive feedback (Lu et al., 2021). These systems can assess essays, assignments, and even coding tasks accurately and consistently. Tools such as *Gradescope*, *Turnitin Draft Coach*, and *Coursera's AI Grader* offer automated evaluation, helping instructors save time while ensuring fairness and consistency in grading. Students benefit by receiving immediate feedback, which enables them to revise and improve their understanding of the subject matter (Holmes et al., 2021).

➤ **Virtual Teaching Assistants**

Virtual teaching assistants are AI-driven systems that support both instructors and learners by providing real-time responses to questions, explanations of concepts, and guidance throughout a course (Fryer et al., 2020). These assistants use NLP and deep learning models to simulate conversational interactions, offering personalized help to students at any time. For instance, *Jill Watson*, an AI teaching assistant developed at Georgia Institute of Technology, responds to routine student inquiries, reducing instructor workload while maintaining engagement in large online classes.

➤ **Collaborative and Social Learning**

AI also enhances collaborative and social learning environments by facilitating communication, peer assessment, and teamwork. AI algorithms can form balanced student groups, monitor participation, and suggest interventions to improve collaboration (Holmes et al., 2021). Platforms such as *Microsoft Teams Copilot* and *Google Workspace for Education* use AI tools to recommend resources, manage group tasks, and track engagement. By fostering equitable participation, AI ensures that collaborative learning becomes more productive and inclusive (Ifenthaler & Yau, 2023).

➤ **Gamification**

Gamification is the integration of game design aspects into learning processes to boost motivation, engagement, and retention. AI improves gamification by analyzing learner data and tailoring challenges, feedback, and rewards to individual performance (Nouri et al., 2022). Apps like Duolingo and Kahoot! AI uses reinforcement learning to personalize exercises and difficulty levels. The dynamic nature of AI-powered gamified learning encourages perseverance, enjoyment, and mastering of complex concepts (Al-Azawei et al., 2023).

ROLES OF AI-ASSISTED INSTRUCTIONAL STRATEGIES IN EFFECTIVE LEARNING IN PRIMARY SCHOOLS

The term "AI-assisted instructional strategies" describes methods of teaching and learning that make use of AI technologies (such as generative models, adaptive learning platforms, learning analytics, and intelligent tutoring systems) to help teachers make decisions, provide feedback, customize content, and shape instruction. These methods must be safe, age-appropriate, and intended to enhance basic literacy, numeracy, social and emotional development, and curiosity rather than take the position of human teachers in primary schools (approximately ages 5–11). Recent systematic reviews and meta-analyses report generally positive effects of AI tools (especially intelligent tutoring systems) on learning outcomes when used thoughtfully alongside teachers (Létourneau et al., 2025; Lee, 2024).

- **Personalization and Adaptive Instruction:** personalization is one of AI's most potent classroom functions; it adapts the speed, content, and scaffolding to each student's current proficiency level. Adaptive learning platforms offer tasks that fill in knowledge gaps or build on strengths while continuously modeling student understanding. Research indicates that when combined with instructor guidance, adaptive and intelligent tutoring technologies result in quantifiable improvements in student achievement across K–12 courses. (Létourneau et al., 2025; Lee, 2024).
- **Immediate, High-Quality Formative Feedback:** AI can offer quick, personalized feedback that clears up misunderstandings, gives helpful recommendations, and patiently explains mistakes. Timely corrective feedback aids in the consolidation of foundational abilities in young learners. Specific and scaffolded feedback from intelligent tutoring systems is linked to improved motivation and exam outcomes (U.S. Department of Education, 2023).
- **Diagnostic Assessment and Learning Analytics:** Daily learning data is transformed into useful diagnostic information by AI-driven analytics. Early identification of learning gaps, progress monitoring against curriculum requirements, and recommendation of focused interventions are typical duties (Akgun et al., 2021).
- **Scaling Individualized Practice and Differentiated Instruction:** Practical differentiation in schools with a wide variety of skill levels is made possible by AI. When combined with high-quality instruction, case studies of schools implementing AI-driven personalized learning show increases in student engagement and academic advancement (Lee, 2024).
- **Content Creation and Lesson Planning Support:** Teachers can cut down on preparation time by using generative AI to assist them develop differentiated worksheets, formative assessments, story prompts, and age-appropriate practice items. These resources need to be used sensibly and their accuracy checked (U.S. Department of Education, 2023).
- **Promoting Inclusivity and Accessibility:** Access for students with special needs can be enhanced by AI tools: Multimodal explanations, automatic captioning, text-to-speech and speech-to-text, and adjustable reading levels all contribute to a variety of content entry points (Akgun et al., 2021).

- **Developing 21st-Century Competencies:** AI-assisted techniques can support digital literacy, problem-solving, and metacognition abilities in addition to topic knowledge. Children can learn how to assess information and consider learning strategies through guided AI interactions (Lee, 2024).

IMPACTS OF AI ON ACADEMIC PERFORMANCE OF PRIMARY SCHOOL PUPILS

Impacts of augmented reality (AR) and virtual reality (VR) integration on academic performance of primary school pupils

The integration of Augmented Reality (AR) and Virtual Reality (VR) technologies in primary education has significantly enhanced pupils' academic performance by improving engagement, comprehension, and retention of learning materials. AR and VR create immersive and interactive learning environments where abstract subjects are visualized in three-dimensional forms, allowing young learners to explore and understand complex concepts more intuitively (Zhou & Wang, 2023). For instance, pupils can experience virtual field trips to historical sites or observe scientific processes like plant growth in real time, which fosters curiosity and critical thinking. According to Li and Chen (2024), AI-enhanced AR and VR applications adapt instructional content to individual learning speeds and styles, providing personalized experiences that promote mastery-based learning. These immersive tools also cater to different learning modalities visual, auditory, and kinesthetic ensuring inclusivity among diverse learners. Moreover, the interactive nature of AR/VR lessons reduces classroom boredom and enhances motivation, which directly correlates with higher academic achievement (Gupta et al., 2025).

Impacts of automated administrative tasks on academic performance of primary school pupils

Automated administrative tasks, powered by Artificial Intelligence (AI), have improved the academic performance of primary school pupils by reducing teachers' workload and increasing time for effective teaching. Through automated systems such as attendance tracking, grading, and performance analysis, teachers can focus more on personalized instruction rather than paperwork (Nguyen & Patel, 2025). These tools provide accurate data that help teachers monitor progress, identify learning gaps, and adjust teaching strategies to meet pupils' needs (Li & Chen, 2024). Automated grading also gives pupils quick feedback, motivating them to learn and improve continuously (Gupta & Lee, 2025). Additionally, automation improves communication between teachers and parents, strengthening support for children's education. Overall, by saving time and improving accuracy, automated administrative tasks indirectly enhance pupils' academic success and classroom engagement (World Economic Forum, 2024).

Impacts Speech of speech and language processing on academic performance of primary school pupils

Speech and language processing (SLP), a branch of Artificial Intelligence (AI), has significantly improved the academic performance of primary school pupils by enabling more interactive and personalized learning experiences. Through AI-powered tools such as voice recognition, text-to-speech, and language translation systems, pupils can engage more effectively with learning materials, especially those who struggle with reading or language barriers (Li & Chen, 2024). These technologies support literacy development by providing immediate pronunciation feedback, vocabulary enhancement, and comprehension support (Nguyen & Adeoye, 2025). SLP also assists teachers in assessing pupils' oral communication and identifying speech or learning difficulties early, leading to timely interventions and better academic outcomes (Zhou & Wang, 2023). Moreover, AI-based language tutors encourage inclusive education by helping pupils with disabilities or second-language learners participate fully in classroom activities. Overall, speech and language processing enhances communication, understanding, and participation, which are key factors in improving pupils' academic performance (World Economic Forum, 2024).

The impact of AI-powered content creation on academic performance of primary school pupils

The design, delivery, and evaluation of educational resources are all being altered by artificial intelligence (AI), which is becoming a more powerful force in the field. AI-powered content production has become a popular tool in elementary education to help teachers create individualized and flexible learning experiences. Students' academic performance now benefits from the combination of data-driven insights and sophisticated algorithms that maximize learning outcomes rather than being exclusively dependent on human-generated content (Williamson & Piattoeva, 2021).

The improvement of student interest and engagement is one of the main effects of AI-powered content production. Interactive activities, visual assistance, and narrative components are examples of AI-generated content that can pique the interest of young students (Johnson, 2022). Students can engage with topics that are neither too easy nor too tough thanks to the customization feature, which maintains the ideal degree of difficulty to improve concentration and memory (O'Neil, 2021). Students exhibit better learning attitudes and increased levels of participation as a result. Assessments produced by AI also offer insightful information about students' learning development. AI can identify learning gaps and provide individualized solutions by examining students' replies (Holmes et al., 2019). This procedure facilitates ongoing academic success improvement and improves formative assessment. AI systems' instant feedback enables students to quickly clear up misconceptions and boost their self-confidence in their capacity to learn.

The impact of AI-powered behavioural and emotional intelligence on academic performance of primary school pupils

The academic performance of primary school pupils has traditionally been attributed to cognitive intelligence and intellectual abilities. However, emerging research in psychology

and education suggests that non-cognitive factors, particularly behavioural and emotional intelligence, play a crucial role in shaping students' academic outcomes (Goleman, 1995; Petrides et al., 2016). Behavioural intelligence involves the capacity to regulate one's actions, manage impulses, and interact appropriately in social and academic settings. Emotional intelligence (EI), on the other hand, refers to the ability to recognize, understand, and manage one's emotions and those of others (Mayer, Caruso, & Salovey, 2016). Both behavioural and emotional intelligence are essential determinants of learning engagement, motivation, and interpersonal relationships within the school environment. Behavioural intelligence directly influences the way pupils approach learning tasks and classroom interactions. Pupils with strong behavioural self-regulation are more likely to follow instructions, remain attentive, and complete assignments on time (Duckworth & Seligman, 2017).

Furthermore, behavioural intelligence affects pupils' perseverance in the face of academic challenges. Pupils who can manage frustration and persist in completing difficult tasks develop resilience, a trait associated with improved learning outcomes (Eisenberg et al., 2010). Conversely, poor behavioural control often leads to classroom disruptions, low attention spans, and a decline in academic achievement. Emotional intelligence contributes significantly to pupils' ability to navigate the emotional and social dimensions of learning. Goleman (1995) identified five components of emotional intelligence, self-awareness, self-regulation, motivation, empathy, and social skills all of which play a role in determining a child's capacity to learn effectively. In the primary school context, emotional intelligence allows pupils to manage anxiety during tests, maintain focus, and build positive relationships with peers and teachers (Petrides et al., 2016).

METHODOLOGY

In carrying out the study, descriptive survey design was adopted. The study was carried out in Uyo Metropolis. The targeted population for the study comprised all the primary school pupils in Uyo Metropolis. A simple random sampling technique was used to select a total of 100 respondents used for the study. The instrument used for data collection was a structured questionnaire titled, "AI-Assisted Instructional Strategies and Academic Performance of Primary School Pupils Questionnaire (AIAISAPPSPQ)". Face and content validation of the instrument was carried out by an expert in test, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration. The reliability coefficient obtained was 0.85, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical technique such descriptive statistics to answer research questions.

RESULTS AND DISCUSSIONS

Research questions 1: The research question sought to find out the extent of using AI-assisted instructional strategies for effective learning in primary schools. To answer the research percentage analysis was performed on the data, (see table 1).

Table 1: Percentage Analysis Extent of Using AI-Assisted Instructional Strategies for Effective Learning in Primary Schools.

Extent	Frequency	Percentage
HE	12	20*
LE	18	30
VLE	30	50**
7TOTAL	60	100%

** The highest percentage frequency

* The least percentage frequency

SOURCE: Field survey

The result of the descriptive analysis presented in Table 1 shows that the highest percentage (50%) of respondents indicated that the extent of using AI-assisted instructional strategies in primary schools is **very low (VLE)**, while the least percentage (20%) reported a high extent (HE). This result disagrees with previous expectations about the adoption of AI in education. The low usage may be due to factors such as inadequate teacher training, limited access to AI technologies, insufficient school infrastructure, and low awareness of AI tools among educators. This result disagreed with the findings of Lee (2024) who stated that in primary school settings, investigations into AI literacy education reveal that children engaged with AI-infused tasks (project-based, programming, human-agent interaction) exhibited positive academic outcomes, including improved knowledge acquisition, higher engagement and more consistent performance. The difference that exists between this result and the previous findings may be due to the fact that in Nigeria AI is not massively appreciated and utilized. This negative attitude towards the use of AI prevents the full implementation of AI-assisted instructional strategies despite their potentials in enhancing teaching and learning.

Research Questions 2: The research question sought to find out the roles of AI-assisted instructional strategies for effective learning in primary schools. To answer the research percentage analysis was performed on the data, (see table 2).

Table 2: Percentage Analysis of the Roles of AI-Assisted Instructional Strategies for Effective Learning in Primary School

Roles	Frequency	Percentage
Personalization and Adaptive Instruction	14	23.33**
Immediate, High-Quality Formative Feedback	13	21.67
Diagnostic Assessment and Learning Analytics	8	13.33
Scaling Individualized Practice and Differentiated Instruction	9	15.00
Content Creation and Lesson Planning Support	8	13.33
Promoting Inclusivity and Accessibility	5	8.33
Developing 21st-C entury Competencies	3	5*
TOTAL	60	100%

** The highest percentage frequency

* The least percentage frequency

SOURCE: Field survey

The above table 2 presents the result of the descriptive analysis of the out the roles of AI-assisted instructional strategies for effective learning in primary school. From the result of the data analysis, it was observed that the highest percentage of the respondents affirmed “Personalization and Adaptive Instruction, (23.33%)”, as the roles of AI-assisted instructional strategies for effective learning in primary school while the least percentage (5%) of the respondents affirmed that the role is “Developing 21st-Century Competencies”. This finding agrees with the opinion of Lee, (2024) who stated that AI-assisted techniques can support digital literacy, problem-solving, and metacognition abilities in addition to topic knowledge. Children can learn how to assess information and consider learning strategies through guided AI interactions.

CONCLUSION

The assessment of AI-assisted instructional strategies shows that these tools significantly enhance primary school pupils’ understanding and engagement in Uyo Metropolis. AI applications provide personalized learning experiences that support individual learning needs and improve academic performance. Teachers using AI-based resources achieve better classroom management and instructional efficiency. Pupils exposed to AI tools demonstrate improved motivation, participation, and mastery of basic

concepts. Despite challenges such as limited infrastructure and digital skills, AI remains a powerful catalyst for modernizing primary education. Overall, AI-assisted instruction contributes meaningfully to improved learning outcomes and a more effective educational system in Uyo.

RECOMMENDATIONS

- Government and school administrators should supply reliable electricity, internet access, and functional digital devices to support effective AI-assisted teaching.
- Continuous professional development programs should be organized to equip teachers with the skills needed to integrate AI technologies into classroom instruction.
- Educational stakeholders should design AI-based instructional materials tailored to the learning levels and needs of primary school pupils.

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