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Utilisation of Artificial Intelligence in Teaching Digital Technologies for Sustainable Solutions in Senior Secondary School in Obio/Akpor Local Government Area

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Abstract

This study investigated the implementation and effectiveness of Artificial Intelligence (AI) tools in teaching digital technologies for sustainable solutions in public senior secondary schools in Obio/Akpor Local Government Area of Rivers State, Nigeria. The study adopted a descriptive survey research design. The population comprised thirty-three public senior secondary schools, from which a sample of nine schools and three hundred (300) respondents were selected using the Taro Yamene formula and quota sampling technique. Data were collected using a self-structured questionnaire titled Implementation and Effectiveness of Artificial Intelligence Tools in Teaching Digital Technologies (IEAITTDT), rated on a four-point Likert scale. The instrument was validated by three experts and achieved a reliability coefficient of 0.80 through pilot testing. Mean and standard deviation were used to answer the research questions. Findings revealed that the implementation of AI tools in the sampled schools was critically low, as essential digital infrastructure such as computers, interactive whiteboards, and internet-enabled classrooms is largely unavailable. However, where AI tools were accessible, respondents reported significantly positive impacts, including enhanced personalized learning, improved student engagement, and better comprehension of complex concepts. Respondents also strongly agreed on the need for teacher training, government investment in ICT infrastructure, and provision of computer laboratories as key improvement strategies. The study concluded that while AI tools hold considerable promise for transforming digital technology education, their potential remains largely unrealised due to persistent infrastructural deficits, inadequate funding, and insufficient teacher capacity. It was recommended that policymakers and school administrators make deliberate investments in infrastructure, teacher development, and policy frameworks to enable effective AI integration in secondary schools.

Keywords: Artificial Intelligence, Digital Technologies, Implementation, Effectiveness, Sustainable Solutions.

Introduction

Modern schooling has been significantly disrupted by artificial intelligence (AI). In general, AI consists of computer programs that do tasks that require human intellect. Problem-solving, understanding language, reading comprehension, and decision-making skills are among them. Educational institutions throughout the world are quickly adopting AI-powered technologies to personalise learning experiences, streamline assessment, improve delivery of training, and improve student outcomes. International organisations such as UNESCO have consistently highlighted the need for the responsible and ethical development of AI in education, stating that AI, when used appropriately, can promote the accessibility and equity of quality education worldwide.

Systems that respond to pupils' requirements, as AI technology's advancement continues, make the future of education bright, claims Kobi Cohen (2024). One of the major advantages of AI in education is personalised instruction. AI helps to mitigate this difficulty by offering personalized coaching to pupils and the crucial academic content to learn difficult topics at their own pace. The regular classroom generally does not suit the diverse educational needs of the children. The University of San Diego (2026) notes that as AI progresses, so does its ability to revolutionise education and create personalised, accessible, and meaningful learning.

Nigeria's education industry is digitising, but it's still a work in progress. The introduction of digital technologies into senior high school education has required new teaching approaches to mirror the global technical progress. Digital technologies – electronic tools, methods, equipment and resources used to collect, store and manipulate data – have become vital to productivity and efficiency across industries. Data transfer and digital signal processing are faster in digital cameras, personal computers and many other devices.

It is important to note that digital technologies have now been included as one of the five key courses in the Federal Ministry of Education's New Revised Senior Secondary School Curriculum on Digital Technologies SSS 1 (2025). The program deliberately equips students with basic and advanced digital technology skills for everyday use. Its broad goals are to educate the ideas and principles of digital literacy, critical thinking and problem solving, digital communication and collaboration, digital economy entrepreneurship, digital ethics, data privacy, and cybersecurity. The program is competency-based and outcome-driven. It stresses practical, transferable skills to equip students for lifelong learning and constructive participation in a technology-driven environment. According to UNESCO, digital skills are "the ability to safely and appropriately use digital technologies to access, manage, understand, integrate, communicate, evaluate and create information for employment, entrepreneurship and meaningful participation in the modern economy" (UNESCO Institute for Statistics, 2018).

AI Tools in Teaching Digital Technologies

AI techniques have been demonstrated to be promising for boosting the digital literacy of kids. Examples of this include intelligent tutoring, virtual assistants, adaptive learning platforms, generative AI applications, AI-based coding environments, virtual laboratories, adaptive LMSs, automated assessment systems, and educational chatbots. The tools assist teachers in providing instruction and students in receiving instruction. AI technologies are quickly being used, and researchers think they boost instructional quality, digital skills and academic performance in Nigerian classrooms. Senior secondary schools in Obio/Akpor Local Government Area can utilise AI-powered instructional software, smart classrooms with digital boards, online learning platforms, computer-assisted programming sessions, and AI-supported project-based learning. However, the degree and quality of implementation are affected by school ownership, budget, infrastructure and teacher digital competence.

Effectiveness of AI Tools in Teaching Digital Technologies

There are different ways to assess the educational effectiveness of AI systems. First of all, AI technologies provide engaging learning environments that boost students' engagement and motivation. Digital simulations, virtual assistants and gamified learning platforms are increasing involvement in education, and research has shown that they are improving students' academic achievement (Kandukoori, et al, 2024).

Second, AI systems provide personalised learning by adapting lessons to the speed and performance of each student. Adaptive learning technologies are used to identify students' learning deficits and recommend instructional materials that improve the understanding and retention of digital technology concepts. Third, AI technologies automate labour-intensive processes including grading, lesson planning, and classroom management, allowing educators to focus on teaching and student support. Agadaba, et al. (2025) assert that artificial intelligence increases the effectiveness of teaching and administration of education in Nigerian schools. Finally, AI-enhanced learning environments expose students to real-world uses of technology and, thus, boost their digital skills. These tools teach pupils coding, computational thinking, problem-solving, and digital communication skills critical for professions in the digital economy. UNESCO (2026) highlights the increasing demand for AI competencies to equip students for an interconnected, technology-driven society.

Challenges Affecting AI Implementation in Senior Secondary Schools

There are several advantages of AI technologies; however, there are some barriers to the application of AI technology in senior secondary schools, especially in the Obio/Akpor Local Government Area. Poor infrastructure is a big problem. Many local schools do not have functional computer laboratories, steady internet access, continuous power supply, advanced smart learning facilities, etc., for substantial integration of AI. Research has shown that a lot of secondary schools in Nigeria lack the required digital tools (Madu, 2025).

Another concern is the absence of digital and AI capabilities among teachers. Many teachers are not equipped to deploy AI technologies in their classrooms due to a lack of continuous professional development and ICT training programs. Underfunding means that many educational institutions can't afford IT infrastructure, software and upkeep. Other difficulties include data privacy, academic dishonesty, abuse of technology and misinformation. According to UNESCO, just 10% of educational institutions have explicit guidelines regarding AI, pointing to the necessity for robust regulatory frameworks. Others, such as school administrators and educators, resist change due to fear of technical complexity, job displacement, or lack of information, which slows AI adoption. World Bank research (2023) points to insufficient infrastructure as a key barrier to digital learning in less wealthy countries.

Strategies for Effective AI Integration

Recommendations on a number of strategic efforts to increase the deployment and efficacy of AI tools in digital technology education. This includes sustained funding by governments for ICT infrastructure, reliable energy and internet connectivity to schools and regular teacher training and digital literacy programmes. We need clear laws around AI education, ethical norms, and public-private partnerships to develop and provide instructional tools. Other strategies include formalisation of AI concepts into the senior secondary school curriculum; use of AI-based systems to monitor and evaluate learning outcomes; equipping school computer laboratories with modern technology; exploring solar-powered backup systems to deal with electricity issues; and use of mobile-friendly AI platforms to reach underserved students.

Sustainability and Digital Technology Education

Digital technology education is essential to the sustainable use of resources that can be maintained forever without destroying the environment or hurting others. "Sustainability in education empowers people with the knowledge, skills, attitudes and behaviours to live in ways that are good for the environment, economy and society," UNESCO adds, "to tackle our planet's urgent problems." Digital technology education in senior secondary schools aims to prepare students to make educated and responsible decisions that contribute to a sustainable and equitable future. Goal 4 of the United Nations Sustainable Development Goals is to ensure inclusive, equitable quality education for all by 2030, and digital technologies are crucial to accomplishing this goal. The study was carried out in Obio/Akpor LGA, one of the fastest-expanding metropolitan areas in Rivers State. While there are many public and private secondary schools and a thriving educational climate, there is no concrete information about how AI tools are being utilised to teach digital technologies and how effective they are. The project investigates the application of AI tools in teaching digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor Local Government Area.

Digital technology advancements are rapidly changing education institutions throughout the world. The ways in which knowledge is conveyed, received and used are evolving, especially through artificial intelligence (AI), and at all levels of schooling. Around the world, teachers and leaders are discovering that artificial intelligence technologies can personalise learning, boost the efficiency of education, and foster student innovation. But despite this global momentum, poor countries and their educational institutions are lagging in the adoption and use of AI technologies to teach digital technology. Nigeria has embraced digital technology in secondary school with both enthusiasm and challenges. National education regulations such as the National Policy on Education and a host of ICT-in-education frameworks have promoted technology in classrooms, but implementation at the grassroots level has been uneven. These shortcomings are a menace to senior secondary institutions bridging basic and higher education. This cohort of pupils requires new digital tools and technology to get ready for the quickly changing information-based economy. Technology-enriched education has not yet been embraced by many of the schools in Nigeria. The study examined the application of AI technology in senior secondary schools in Obio/Akpor Local Government Area.

The study investigated the implementation and effectiveness of artificial intelligence tools for teaching digital technologies for sustainable solutions in public senior secondary schools in Obio/Akpor Local Government Area. Specifically, the objectives of the study were to:

1. examine the extent of implementation of AI tools for teaching digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor.
2. determine the impact of AI tools for teaching digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor.
3. Examine the strategies that can improve the utilisation of AI tools for teaching sustainability-focused digital technology.

The following research questions guided the study:

1. To what extent are AI tools currently being implemented in the teaching of digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor Local Government Area?
2. What is the impact of AI tools on the teaching and learning of digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor Local Government Area?
3. What strategies can be adopted to improve the utilisation of AI tools in teaching sustainability-focused digital technology in senior secondary schools in Obio/Akpor?

Methodology

The study adopted a descriptive survey research design. The population of the study comprised thirty-three (33) public senior secondary schools. A sample size of nine (9) schools was drawn using the Taro Yamene formula, and three (300) hundred respondents was realized through Quota sampling technique. Quota sampling technique was adopted to allocate a specific number to respondents in each of the schools. A self-structured questionnaire titled, Implementation and Effectiveness of Artificial Intelligence Tools in Teaching Digital Technologies (IEAITTDT). The instrument was a self-structured questionnaire rated on a 4-point Likert scale. The instrument was validated by three experts and 0.80 score was obtained using pilot testing for the reliability of the instrument. The instrument was administered to the respondents by the researcher and two research assistants. However, due to delay and unavailability of the some of the respondents, the researcher recorded a return rate of 96% which amounted to 288 copies of the questionnaire received out of 300 copies distributed to the respondents. Mean and standard deviation were used to answer the research questions using a benchmark of 2.50 (i.e., mean $\geq$ 2.50 = Agreed/Implemented).

Results

Table 1: Mean and Standard Deviation of the extent to which AI tools are currently being implemented in the teaching of digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor Local Government Area (n=288)

S/N	Items					Mean ($\bar{x}$)	SD	Remark
		HI	MI	LI	NI			
1	Desktop or laptop computers	4	3	2	1	1.39	0.69	LI
2	Multimedia projectors	2	29	47	210	1.03	0.24	LI
3	Interactive whiteboards	0	3	5	282	1.04	0.26	LI
4	Internet-enabled classrooms	0	4	3	281	1.01	0.08	LI
5	School websites or online portals for learning	0	0	2	286	1.13	0.52	LI
	Grand mean						1.12	

Keys: HI = High Implementation, MI = Moderate Implementation, LI = Low Implementation, NI = No

Table 1 presents the mean scores and standard deviations for five items assessing the usage of AI-related tools in digital technology education. Everything tells a sorry tale. The highest mean score was for desktop or laptop computers, 1.39 (SD = 0.69), which was still below the cut-off mean of 2.50, indicating low implementation.

Multimedia projectors 1.03 (SD = 0.24), interactive whiteboards 1.04 (SD = 0.26), internet equipped classrooms 1.01 (SD = 0.08) and school websites or online learning portals 1.13 (SD = 0.52). The overall mean of 1.12 of all the five criteria indicates that the extent of implementation of the AI tools in the researched schools is quite low and just over the “Not Implemented” barrier in the four-point scale.

Table 2: Mean and Standard Deviation of the impact of AI tools on the teaching and learning of digital technologies for sustainable solutions in senior secondary schools in Obio/Akpor Local Government Area(n=288)

S/N	Items	SA	A	SD	DA	Total (N)	Mean (x)	SD	Remark
6	AI tools are readily available for students during digital technology lessons.	8	10	190	80	288	1.13	0.52	D
7	AI tools provide explanations that are easy to understand.	40	198	27	23	288	2.89	0.67	A
8	AI tools expose me to real-world sustainable technology solutions.	140	88	37	23	288	3.20	0.87	SA
9	AI tools increase my interest in learning digital technologies.	120	99	50	19	288	3.11	0.86	SA
10	AI tools make difficult topics easier to understand.	100	130	38	20	288	3.08	0.83	SA
Grand mean								2.83	

Keys: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 2 shows respondents' ratings of AI technologies' influence on teaching and learning: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). Results show a dramatic discrepancy between AI tool availability and perceived efficacy when accessible. Item 6—whether AI tools are available to pupils during digital technology lessons—had a very low mean of 1.13 (SD = 0.52), with 190 respondents disagreeing and 80 severely disagreeing. Items 7-10 give a different narrative. Item 7, which examined whether AI technologies give clear explanations, had a mean of 2.89 (SD = 0.67), suggesting agreement. Items 8, 9, and 10 all exceeded 3.0: respondents strongly agreed that AI tools expose them to real-world sustainable technology solutions (Mean = 3.20, SD = 0.87), increase their interest in learning digital technologies (Mean = 3.11, SD = 0.86), and simplify difficult topics. AI tools' positive effects are supported by the table's grand mean of 2.83, which exceeds the criteria mean of 2.50.

Table 3: Mean and Standard deviation of strategies that can be adopted to improve the utilization of AI tools in teaching sustainability-focused digital technology in senior secondary schools in Obio/Akpor(n=288)

S/N	Items	SA	A	SD	D	Mean		Remark
11	Providing school computer laboratories.	121	100	37	30	3.08	0.93	
12	Government investment in ICT infrastructure	127	96	47	18	3.15	0.89	High
13	Regular teacher training and digital literacy programs.	119	110	49	10	3.18	0.82	Very high
14	Installing solar-powered backup systems.	81	109	36	62	2.73	1.05	Moderate
15	Monitoring and evaluation of AI-based learning outcomes.	98	87	28	75	2.72	1.13	Moderate
Grand Mean								2.97

Keys: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 3 shows respondents' assessments of five AI integration options for teaching sustainability-focused digital technologies. All five questions scored over the criteria mean of 2.50, showing broad agreement that the tactics are important and necessary. Regular teacher training and digital literacy programs scored the highest at 3.18 (SD = 0.82), indicating that strengthening teacher capacity is the most important improvement measure. Government investment

in ICT infrastructure (Mean = 3.15, SD = 0.89) and school computer laboratories (Mean = 3.08, SD = 0.93) follow, reflecting schools' urgent demand for physical and technological resources. Moderate agreement was found for installing solar-powered backup systems (Mean = 2.73, SD = 1.05) and monitoring and evaluating AI-based learning outcomes (2.72, 1.13). Both items had the biggest standard deviations in the table, indicating more variety in respondents' beliefs. Table 3's grand mean of 2.97 shows that intentional, multi-pronged measures are needed to boost AI use.

Discussion

This section discusses the findings of the study in relation to existing literature on the implementation and effectiveness of Artificial Intelligence (AI) tools in teaching digital technologies in senior secondary schools in Obio/Akpor Local Government Area.

AI Tools in Teaching Digital Technologies

The average scores for inadequacy in the use of AI-related technology, including desktop computers, multimedia projectors, interactive whiteboards, internet-enabled classrooms and school portals, are between 1.01 and 1.39. Most schools lack the tech to integrate AI, meaning that. Madu (2025) argued that many secondary schools in Nigeria are without computer laboratories, internet access and updated teaching materials. The World Bank (2023) observed that weak infrastructure is a barrier to digital learning in the poorest countries. The study also corroborates Haleem et al. (2022) on the problems in the implementation of educational technology due to infrastructural challenges and unequal access to digital resources. However, the application of AI in the study area is restricted. However, AI in education is becoming more popular throughout the world.

AI Tools in Enhancing Learning

Except for availability (Item 6), mean scores from 2.89 to 3.20 indicate that AI tools increase students' knowledge of digital technology, with a low mean score of 1.85. Students using AI tools, however, not often available, see them as advantageous. Kandukoori et al. (2024) revealed that digital learning tools significantly improved student academic success as compared to traditional teaching methods. Kobi Cohen (2024) noted that AI gives personalized learning and aids students in understanding difficult concepts with high scores for enhanced knowledge, engagement, and exposure to real-world applications. The results validate the conclusions of UNESCO (2026) who discovered that AI technologies enable engagement, personalised learning and digital skills. Low availability of AI tools (Item 6) confirms a previous conclusion that infrastructure remains a critical obstacle. This distinction separates possible benefits of AI from its usage in schools.

Strategies for Improving AI Implementation

Strategies to improve AI implementation enjoyed consensus. The results complement Agadaba and Omokaro (2025), who highlighted the need for teacher competency and institutional support for AI integration. UNESCO guidance emphasises the need for policy formulation, investment in infrastructure and preparation of teachers. While these approaches are important for sustainability and long-term success, respondents may not have prioritised them. The findings are in line with Aduloju et al. (2026), who showed that while educators perceive AI's benefits, finance, infrastructure and teacher preparedness influence its adoption. This means that the major challenges are availability and application of AI tools, rather than their effectiveness. The findings support the literature, which emphasises the need for better infrastructure, financing and teacher ability to properly use AI in education. UNESCO says AI can transform education and help achieve sustainable development objectives by enhancing digital skills and quality education. But realising that potential will need legislative changes and investment in instructional technologies.

Conclusion

The study revealed that the senior secondary schools in Obio/Akpor Local Government Area rarely employ Artificial Intelligence tools despite its potential to promote digital technology education. AI technology proved its effectiveness as students reported better knowledge, engagement and learning outcomes. The main barrier to the use of AI technology in education is the lack of infrastructure, funding and teacher training. Thus, the education stakeholders need to concentrate on closing the gap between the potential benefits of AI and real-life applications in the classrooms.

Recommendations

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

1. Government, school authorities, private organisations, and well-meaning individuals should provide adequate ICT facilities such as computer laboratories, internet access, and smart classrooms to support AI-based learning.
2. There should be increased investment in educational technology to ensure the acquisition, maintenance, and upgrading of AI tools in schools.
3. Regular training programs should be organised to equip teachers with the necessary digital and AI skills required for effective instructional delivery.
4. Schools should be equipped with reliable electricity sources, including solar-powered backup systems, to ensure continuous use of digital tools.
5. Educational authorities should develop clear policies and guidelines for the integration of AI in teaching and learning.
6. There should be continuous monitoring and evaluation of AI-based learning to ensure effectiveness and accountability.

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