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EFFECT OF KYAN MACHINE-ASSISTED INSTRUCTION ON STUDENTS' ACADEMIC PERFORMANCE IN SECONDARY SCHOOLS IN JIGAWA STATE, NIGERIA

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ABSTRACT
The integration of digital instructional technologies in secondary education has become an important strategy for improving teaching effectiveness and student learning outcomes. This study examined the effect of Kyan Machine–assisted instruction on students' academic performance in selected secondary schools in Jigawa State, Nigeria. A quasi-experimental research design was adopted to compare the academic achievement of students taught using Kyan Machine–supported lessons with those taught using conventional teaching methods. The study involved a sample of 300 senior secondary school students selected from ten public secondary schools, comprising five Science Secondary and five Non Science secondary schools. The sample size was determined using the Taro Yamane formula, and students were divided into experimental and control groups. Data were collected using a Students' Achievement Test designed to measure academic performance in core subjects taught during the instructional period. The instrument was validated by experts in educational technology and measurement, while reliability testing using the Kuder–Richardson (KR-20) method produced a coefficient of 0.78, indicating acceptable internal consistency. Data were analysed using descriptive statistics and an independent sample t-test at a 0.05 level of significance. The results revealed that students exposed to Kyan Machine–assisted instruction achieved higher mean scores ($M = 68.4$, $SD = 8.2$) compared with students taught using conventional teaching methods ($M = 56.3$, $SD = 9.5$). The independent sample t-test indicated a statistically significant difference in academic performance between the two groups ($t(298) = 9.87$, $p < 0.05$), suggesting that the use of the Kyan Machine positively influenced students' learning outcomes. The findings highlight the potential of multimedia-supported instruction to enhance conceptual understanding and improve classroom learning experiences. The study concludes that Kyan Machine–assisted instruction can significantly improve students' academic performance when effectively integrated into classroom teaching. It therefore recommends increased adoption of digital instructional technologies, teacher training on multimedia-based pedagogy, and improved technical support systems to maximise the benefits of educational technology in secondary schools.

Keywords: Kyan Machine, digital instructional technology, academic performance, secondary education, Jigawa State.

Introduction

The use of Information and Communication Technology (ICT) in education has become an important strategy for improving teaching effectiveness and learning outcomes. Digital instructional tools enable teachers to present lessons using multimedia resources that enhance visualization, improve concept explanation, and encourage active student participation (Adewale & Musa, 2021; Federal Ministry of Education [FME], 2019). Consequently, many education systems have adopted technology-based instructional approaches to address persistent challenges such as limited instructional materials, teacher shortages, and declining academic performance.

In Nigeria, the integration of ICT into education has been promoted through the National Policy on ICT in Education, which encourages the use of digital learning technologies at all levels of the educational system (FME, 2019). The policy supports the introduction of multimedia instructional devices and smart classroom technologies to improve the quality of teaching and learning. In addition, the increasing use of computer-based testing in national examinations has further highlighted the need for students to acquire digital learning skills during secondary education.

One of the digital learning innovations introduced in public secondary schools is the Kyan Machine, a portable smart classroom device that integrates a projector, computing system, interactive features, and preloaded curriculum-based instructional content. The device allows teachers to deliver multimedia lessons without requiring continuous internet connectivity. The design of the Kyan Machine supports visual and interactive learning, which is consistent with the Multimedia Learning Theory that suggests students learn more effectively when instructional materials combine visual and verbal information (Mayer, 2009; Ogunleye, 2019).

In Jigawa State, the introduction of the Kyan Machine formed part of broader educational reforms aimed at modernizing classroom instruction and improving academic performance in public secondary schools. The devices were distributed to selected Centers of Excellence and other designated effective schools as pilot institutions for digital learning innovation. Through this initiative, the state government expected to enhance lesson clarity, increase student engagement, and improve learning outcomes in key subjects. However, despite the introduction of this technology, many public secondary schools in Jigawa State continue to experience educational challenges such as low academic achievement in core subjects, inadequate instructional materials, and the continued dominance of traditional teacher-centered instructional methods (Adewale & Musa, 2021; Ogunleye, 2019). While digital technologies are widely recognized as tools for improving teaching and learning, their effectiveness depends largely on factors such as teacher competence, infrastructure availability, institutional support, and consistent utilization (Rogers, 2003). In contexts where these supporting conditions are weak, the introduction of instructional technologies may not necessarily translate into improved learning outcomes.

Furthermore, although the Kyan Machine has been introduced into selected secondary schools in Jigawa State, empirical evidence regarding its actual impact on teaching practices and student learning outcomes remains limited. Most available information focuses on the policy intentions behind the technology rather than its practical implications in classroom settings. This lack of evidence creates uncertainty regarding whether the investment in digital instructional technologies is achieving the expected educational benefits.

Therefore, a systematic assessment of the utilisation and educational implications of the Kyan Machine is necessary. Understanding how frequently the device is used, how it influences instructional delivery, and whether it improves students' academic performance and engagement will provide important insights for policymakers and education stakeholders.

The aim of this study is to examine the effect of Kyan Machine-assisted instruction on students' academic performance in selected secondary schools in Jigawa State, Nigeria. The specific objectives are to: assess the academic performance of students taught using Kyan Machine-assisted instruction in selected secondary schools in Jigawa State, determine the academic performance of students taught using conventional teaching methods in the selected secondary schools, compare the academic performance of students exposed to Kyan Machine-assisted instruction and those taught using conventional instructional methods and determine whether there is a statistically significant difference in academic performance between students taught with Kyan Machine-assisted instruction and those taught using conventional teaching methods.

The study was guided by this research question: Is there a significant difference in academic performance between students taught using Kyan Machine-assisted instruction and those taught using conventional teaching methods in secondary schools in Jigawa State?

Research Hypothesis

1. **H_0:** There is no significant difference in academic performance between students taught using Kyan Machine-assisted instruction and those taught using conventional teaching methods in secondary schools in Jigawa State.
2. **H_1:** There is a significant difference in academic performance between students taught using Kyan Machine-assisted instruction and those taught using conventional teaching methods in secondary schools in Jigawa State.

Theoretical Framework

This study is anchored on the Multimedia Learning Theory (MLT) developed by Richard E. Mayer. The theory explains how learners process and understand information when instructional materials combine words, images, and other multimedia elements. According to the theory, learning becomes more effective when verbal explanations are supported with visual representations because learners can process information through multiple cognitive channels (Mayer, 2009). Multimedia Learning Theory is based on three key assumptions: the dual-channel assumption, which states that individuals process visual and verbal information through separate cognitive channels; the limited capacity assumption, which indicates that each channel has a limited capacity for processing information; and the active processing assumption, which suggests that learners actively organize and integrate information to construct meaningful knowledge (Mayer, 2009). These principles imply that instructional strategies combining text, graphics, animations, and audio can enhance students' comprehension and retention of academic content.

The Kyan Machine supports the principles of Multimedia Learning Theory by enabling teachers to present lessons using digital slides, visual demonstrations, videos, and interactive learning materials. Such multimedia-supported instruction can help simplify complex concepts and improve students' engagement during classroom instruction. Previous studies have shown that multimedia-based teaching approaches significantly enhance students' academic performance and conceptual understanding compared with traditional teacher-centred instructional methods (Bates, 2019; Mayer, 2009). Therefore, Multimedia Learning Theory provides a theoretical basis for this study by explaining how the integration of Kyan Machine–assisted instruction may improve students' learning outcomes. The theory suggests that when digital instructional tools are effectively integrated into classroom teaching, they can enhance cognitive processing and ultimately improve academic performance among secondary school students.

Materials and Methods

1. Research Design

This study adopted a quasi-experimental research design to evaluate the impact of the Kyan Machine instructional technology on students' academic performance in selected secondary schools in Jigawa State. Quasi-experimental designs are commonly used in educational research where random assignment of participants is not feasible due to administrative and ethical constraints (Campbell & Stanley, 1963). In such situations, intact classroom groups are used as treatment and comparison groups while maintaining the natural school environment.

In this study:

Treatment group: students taught using the Kyan Machine-assisted instruction

Control group: students taught using conventional teaching methods

The design allowed the researcher to compare students' academic achievement between the two instructional approaches, thereby determining the effectiveness of the Kyan Machine as a digital instructional tool. The quasi-experimental design is appropriate for evaluating instructional innovations because it enables the measurement of causal relationships between educational interventions and learning outcomes within real classroom settings (Creswell, 2014).

2 Population and Sample Size

The target population of the study comprised Senior Secondary School students (SS I – SS III) in the selected ten public secondary schools in Jigawa State where the Kyan Machine had been deployed for instructional purposes. School records obtained from the respective institutions indicated that the estimated student population across the selected schools was approximately 1,200 students.

To determine an appropriate sample size, the Taro Yamane (1967) formula for finite populations was used. Thus, a sample size of 300 students was considered adequate for the study. To ensure representation across the selected schools, proportionate sampling was used. Students were randomly selected from intact classes in both Kyan Machine classrooms (treatment group) and conventional classrooms (control group).

Table 1: Sample Distribution of the Study

Group	Number of Students
Kyan Machine Instruction Group	150
Conventional Instruction Group	150
Total	300

Source: Researcher's Compile, 2026

The study was conducted in ten public secondary schools in Jigawa State, Nigeria, comprising five Centers of Excellence and five effective secondary schools. These schools were purposively selected to enable a comparison between institutions that were designated as innovation-focused schools and regular public secondary schools where digital learning tools were also deployed.

Centers of Excellence were chosen because they serve as pilot institutions for educational reforms and digital learning initiatives, and they typically receive higher levels of infrastructural support and instructional resources. Effective secondary schools were included to provide a realistic comparison of instructional outcomes in conventional public school environments.

The selection of the schools was based on the following criteria:

1. Availability of functional Kyan Machines used for classroom instruction.
2. Accessibility of the schools for monitoring and data collection.

3. Geographical distribution across different Local Government Areas to ensure representation within the state.
4. Approval and willingness of school authorities to participate in the research.
5. Evidence of prior utilisation of the Kyan Machine before the commencement of the study.

Table 2: Selected Science and Technical Secondary Schools

S/N	School Name	Location (LGA)
1	Government Girls Science Secondary School Jahun	Juhun
2	Government Science Secondary School Kafin Hausa	Kafin Hausa
3	Government Science Secondary School Lautai	Gumel
4	Government Science and Technical Secondary School Hadejia	Hadejia
5	Government Girls Science Secondary School Taura	Taura

Source: Field Survey, 2026

Table 3: Selected Non-Science Secondary Schools

S/N	School Name	Location (LGA)
1	Government Secondary School Babura	Babura
2	Government Secondary School Ringim	Ringim
3	Government Secondary School Kaugama	Kaugama
4	Government Secondary School Gagarawa	Gagarawa
5	Government Secondary School Jahun	Jahun

Source: Field Survey, 2026

3 Instrument for Data Collection

The primary instrument used for data collection was a Students' Achievement Test (SAT) designed to measure students' academic performance in selected core subjects taught during the experimental period. The achievement test consisted of multiple-choice questions covering key curriculum topics in Mathematics and English Language that were taught during the instructional period. The same test was administered to both the treatment group and the control group to ensure comparability of learning outcomes.

3.1 Validity of the Instrument

The test instrument was subjected to content validation by experts in educational technology and measurement and evaluation at Bayero University Kano. Their feedback ensured that the test items adequately covered the learning objectives and curriculum content.

3.2 Reliability of the Instrument

A pilot test was conducted in a secondary school outside the study area. The reliability of the instrument was determined using the Kuder–Richardson Formula 20 (KR-20) suitable for objective test items. The reliability coefficient obtained was 0.78, indicating an acceptable level of internal consistency for educational research (Fraenkel, Wallen, & Hyun, 2012).

4 Data Analysis

Data obtained from the students' achievement test were analysed using descriptive and inferential statistical techniques. Descriptive statistics, including mean scores and standard deviations, were used to summarise students' academic performance in both instructional groups. To determine whether there was a statistically significant difference between students taught using the Kyan Machine and those taught using conventional teaching methods, an independent samples t-test was employed. The t-test is appropriate for comparing the mean performance of two independent groups (Field, 2013).

Results and Discussion

1 Students' Academic Performance under Kyan Machine-Assisted Instruction

To determine the effect of the Kyan Machine on learning outcomes, students' academic performance scores were compared between those taught using Kyan Machine-assisted instruction (experimental group) and those taught using conventional teaching methods (control group).

Table 4: Comparison of Students' Academic Performance between Instructional Groups

Group	N	Mean Score (%)	SD
Kyan-Assisted Instruction	150	68.4	8.2
Conventional Instruction	150	56.3	9.5

Source: Field Survey (2026)

The results in Table 4 show that students taught using Kyan Machine-assisted instruction recorded a higher mean achievement score (M = 68.4, SD = 8.2) compared with students taught using conventional teaching methods (M = 56.3, SD = 9.5). The difference in mean performance between the two groups is 12.1 percentage points, indicating a notable academic advantage for students exposed to digital instructional support. The lower standard deviation observed in the experimental group suggests relatively consistent academic performance among students who experienced Kyan-supported lessons. In contrast, the control group displayed slightly greater variability in performance, which may reflect differences in teaching methods and student engagement within traditional classroom settings.

Test of Significant Difference in Students' Academic Performance

To determine whether the observed difference in mean scores between the two groups was statistically significant, an independent sample t-test was conducted.

Table 5: Independent Sample t-Test Result for Students' Academic Performance

Variable	Experimental Group (Kyan)	Control Group (Conventional)	t-value	Df	p-value
Academic Achievement	68.4 (SD = 8.2)	56.3 (SD = 9.5)	9.87	298	<0.05

Source: Field Survey (2026)

The independent sample t-test result indicates a statistically significant difference in academic performance between students exposed to Kyan Machine-assisted instruction and those taught through conventional methods ($t(298) = 9.87$, $p < 0.05$). Since the calculated p-value is less than the 0.05 level of significance, the null hypothesis of no significant difference is rejected. This result implies that the observed improvement in students' academic performance can be attributed to the use of Kyan Machine-supported instruction. To further estimate the magnitude of the difference, the effect size was calculated using Cohen's with a pooled standard deviation of approximately 8.88, the estimated effect size ($d \approx 1.36$) represents a large effect size based on Cohen's classification.

Discussion of Findings

The findings of this study indicate that students who were taught using Kyan Machine–assisted instruction achieved significantly higher academic performance compared with those taught using conventional teaching methods. The large effect size obtained in the analysis, based on the classification proposed by Jacob Cohen, suggests that the instructional intervention produced not only statistically significant differences but also meaningful practical improvements in students' learning outcomes (Cohen, 1988). This result demonstrates that integrating multimedia-based instructional technologies into classroom teaching can enhance students' academic achievement in secondary schools.

The improvement in students' performance supports the Multimedia Learning Theory proposed by Richard E. Mayer, which explains that learners understand instructional content more effectively when verbal explanations are combined with visual elements such as images, diagrams, and animations (Mayer, 2009). The Kyan Machine facilitates this process by enabling teachers to deliver lessons using digital slides, videos, and visual demonstrations, thereby enhancing cognitive processing and improving students' comprehension of complex topics. This finding is consistent with international evidence indicating that well-integrated educational technologies can significantly improve learning outcomes when used to support structured classroom instruction (UNESCO, 2023; OECD, 2022).

Several instructional factors may explain the observed improvement in academic performance. Multimedia-supported instruction helps simplify abstract concepts, particularly in subjects such as mathematics and science, and enhances the clarity and organisation of lessons. In addition, technology-supported learning environments often increase students' attention, motivation, and participation during classroom instruction (Bates, 2019). The substantial effect size observed in this study further suggests that the Kyan Machine can produce meaningful educational benefits when effectively integrated into classroom practice (Hattie, 2018). However, previous studies emphasise that the effectiveness of instructional technologies depends on factors such as teacher competence, pedagogical integration, and institutional support (Tondeur et al., 2021). Therefore, appropriate teacher training and supportive learning environments remain essential for maximising the educational benefits of digital instructional technologies.

Conclusion

This study examined the effect of Kyan Machine–assisted instruction on students' academic performance in selected secondary schools in Jigawa State, Nigeria, using a quasi-experimental design that compared students taught with Kyan-supported lessons and those taught using conventional teaching methods. The findings revealed that students exposed to Kyan Machine–assisted instruction achieved higher academic performance, indicating that the integration of digital instructional technologies can positively influence learning outcomes when effectively applied in classroom teaching. The results suggest that multimedia-supported instruction enhances lesson clarity, improves students' understanding of complex concepts, and promotes greater engagement during classroom learning. However, the effectiveness of such technologies depends not only on the availability of digital devices but also on factors such as teacher competence, proper integration into instructional practices, and adequate institutional support. Therefore, when digital instructional tools like the Kyan Machine are supported by appropriate teacher training, effective lesson planning, and reliable infrastructure, they can significantly strengthen teaching effectiveness and improve students' academic achievement in secondary schools.

Recommendations

Based on the empirical findings of this study, the following recommendations are proposed:

i. Teachers in secondary schools should integrate the Kyan Machine into regular classroom instruction, particularly in core subjects such as Mathematics, English, and Science, to enhance conceptual understanding through multimedia-supported lessons.
ii. Educational authorities should organise structured training programmes to equip teachers with the skills required to design and deliver effective multimedia-based lessons using the Kyan Machine.

iii. Curriculum-based digital teaching materials aligned with the national secondary school curriculum should be developed and provided to teachers to support effective use of the Kyan Machine in classroom instruction.
iv. Schools should establish technical support and maintenance systems to ensure that Kyan Machines remain functional and available for continuous instructional use.
v. The Jigawa State education authorities should expand the deployment of Kyan Machines to more public secondary schools while ensuring adequate teacher training and technical support.
vi. School administrators and education authorities should regularly monitor students' academic performance in Kyan-assisted classrooms to evaluate the effectiveness of the technology in improving learning outcomes.
vii. Future research should investigate the subject-specific impact of Kyan Machine-assisted instruction in areas such as Mathematics, Biology, and Physics to better understand its educational effectiveness.

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