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Utilization of Artificial Intelligence Tools on Students Interest and Engagement in Basic Science Learning Among Secondary School Students' in Makurdi-Metropolis

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Abstract

This study examines the utilization of Artificial Intelligence (AI) tools on students' interest and engagement in learning Basic Science in secondary school within Makurdi Metropolis. Descriptive survey research design was adopted. Two research questions and two hypotheses guided the study. A sample of 300 students' across 10 secondary schools from the population of 83,500 senior secondary school students across 89 registered secondary schools in Makurdi Metropolis, using simple random sample technique. Instrument used for data collection was a structured questionnaire titled Utilization of Artificial Intelligence Tools and Student Interest and Engagement Questionnaire (UAISEEQ). The questionnaire was administered and data was analyzed using mean and standard deviation to answer the research question while chi-square (X2) statistics were used to test the hypothesis at 0.05 level of significance. utilization of Artificial Intelligent (AI) tools have a significant impact on students' interest in learning Basic Science (X2 = 3, 18.47, P = 0.000 < 0.005), and utilisation of Artificial Intelligent (AI) tools have significant impact on students' engagement in learning Basic Science (X2 = 3, 22.67, P = 0.000 < 0.05). The study recommended among others that school and educational authorities should provide adequate digital infrastructure and organize training programmes for teachers and students on the effective use of artificial intelligence tools. Teachers should integrate AI tools in classroom instruction to enhance student interest and engagement.

Keywords: Artificial Intelligence, Students' Interest, Students' Engagement, Learning, Utilization & Basic Science

INTRODUCTION

Science education is central to preparing learners for the demands of the 21st century, equipping them with the knowledge, skills, and attitudes needed to understand and solve real-world problems. At the lower secondary level (Grade Eight), Basic science serves as a foundation for higher studies in biology, chemistry, and physics, while also nurturing critical thinking, inquiry skills, and technological literacy (UNESCO, 2023). However, despite its importance, science education at this stage often faces challenges that hinder effective learning, including reliance on rote memorization, limited access to laboratory facilities, overcrowded classrooms, and insufficiently engaging instructional methods (Afolabi, 2021, as cited in Fatoki, 2026), particularly in the teaching and learning of Basic Science.

Basic Science served as core subjects in junior secondary schools, designed to improve the foundational knowledge of students to understand scientific concepts, inquiry skills, and attitudes necessary for further study in science and technology-related fields. It integrates concepts from biology, chemistry, physics, and earth science, enabling students to understand their environment, develop problem-solving skills, and apply scientific principles to everyday life (Federal Ministry of Education [FME], 2018). Despite the importance of Basic Science, students' academic performance in the subject has remained a concern in many Nigerian schools. Researchers have attributed this challenge to factors such as inappropriate teaching methods, inadequate instructional materials, poor learning environments, and insufficient linkage between classroom instruction and students' cultural experiences (Fatoki et al., 2026), resulting in poor academic performance. He further observed that meaningful Basic Science education should enable students to connect scientific concepts with their everyday experiences, thereby making learning more relevant and functional to the society.

The conventional lecture method is predominantly teacher-centred, with students often positioned as passive recipients of knowledge. The approach provides limited opportunities for students to actively participate, ask questions, engage in meaningful interaction, or relate scientific concepts to their everyday experiences. The reliance on the lecture method may encourage rote memorization rather than meaningful understanding, thereby limiting students' critical thinking, engagement, retention, and problem-solving abilities Fatoki et al. (2026),

One of the emerging technologies with the potential to support these educational goals is Artificial Intelligence (AI). The rapid development of AI has generated significant interest across different sectors, including education. Artificial Intelligence generally refers to computer-based systems capable of performing tasks associated with human cognitive functions, including learning, reasoning, problem-solving, prediction, language processing, and decision-making. Russell and Norvig (2021) describe AI in terms of systems designed to perform functions associated with intelligent behaviour. In education, AI has increasingly been incorporated into technologies designed to support teaching, learning, assessment, feedback, personalization, and educational decision-making.

The utilization of AI tools in education can therefore be understood as the purposeful integration of AI-powered technologies into teaching and learning processes to support instructional and learning objectives. UNESCO (2023) and Zawacki-Richter et al. (2019) identify personalization, immediate feedback, learner support, and improved interaction as important possibilities associated with AI in education. Rather than viewing AI simply as a replacement for the teacher, its educational value lies substantially in how it can complement teachers' instructional practices and provide learners with additional opportunities for exploration and support. Holmes, Bialik, and Fadel (2020) argue that AI-supported technologies can contribute to personalized instruction and real-time feedback, potentially transforming the teacher's role from being primarily a source of information to becoming a facilitator of

technology-supported learning. This shift is compatible with the learner-centred orientation of contemporary science education. The nature of AI tools available for educational use is diverse. They include adaptive learning platforms, intelligent tutoring systems, automated assessment applications, virtual laboratories, generative AI systems, and research-support applications. Generative AI applications such as ChatGPT and Google Gemini can generate explanations, answer questions, provide examples, assist with brainstorming, and support interactive dialogue (Afolabi & Akinola, 2023). Intelligent tutoring systems can provide individualized instructional assistance, while adaptive platforms can adjust learning activities according to students' performance. Virtual laboratories and simulations can provide opportunities to explore phenomena that may be difficult, expensive, dangerous, or impossible to reproduce within conventional school laboratories.

An important consideration in determining the educational value of AI tools is their capacity to influence students' interest in learning. Students' interest refers broadly to the curiosity, enthusiasm, attention, and willingness that learners demonstrate toward a subject or learning activity. Interest is important because students who find learning meaningful and engaging are more likely to participate actively, sustain attention, explore concepts, ask questions, and persist when confronted with challenging tasks. In science education, interest is particularly important because students' attitudes toward science can influence their willingness to engage with scientific concepts and pursue further learning in science-related areas. The development of students' interest should therefore be regarded as an important objective of Basic Science instruction. (Chen et al., 2024). Consequently, the effective utilization of AI tools has become an important strategy for fostering students' interest in learning Basic Science and improving overall learning engagement.

Academic engagement is the extent to which learners participate actively, emotionally, and cognitively in learning activities. Fredricks, et al, (2021) conceptualize engagement as a multidimensional construct involving behavioural, emotional, and cognitive dimensions. Behavioral engagement concerns students' participation and involvement in learning activities; emotional engagement involves their feelings, interest, enthusiasm, and sense of connection with learning; while cognitive engagement concerns the mental effort and strategies students employ in understanding and applying knowledge. These dimensions are important in Basic Science because meaningful scientific learning requires more than physical presence in the classroom. Students must pay attention, ask questions, reason about evidence, engage with scientific problems, and make connections between concepts and real-world situations. The potential contribution of AI to engagement is especially important in Basic Science classrooms where students may differ substantially in their prior knowledge, learning abilities, interests, and pace of learning.

STATEMENT OF THE PROBLEM

In Basic Science education, AI tools have the potential to enhance students' understanding of scientific concepts, stimulate curiosity, and support active participation in learning activities. Despite these potential benefits, concerns regarding the extent to which students effectively utilize AI tools and how such utilization influences their interest and engagement in learning Science. Students continue to exhibit low interest in Basic Science, poor classroom participation, limited engagement in practical activities, and declining enthusiasm toward science-related subjects. These challenges are due to factors such as inadequate instructional materials, overcrowded classrooms, internet connection, access to computer or smart-phones, insufficient laboratory facilities, and the continued use of traditional teaching methods that may not adequately meet the learning needs of contemporary students. Therefore, the problem of this study is the lack of sufficient empirical information on the impact of the utilization of AI tools on students' interest and engagement in learning Basic Science in secondary schools within Makurdi Metropolis.

Purpose of the Study

The purpose of this study is to examine the impact of the utilization of Artificial Intelligence (AI) tools on students' interest and engagement in learning Basic Science in secondary schools within Makurdi Metropolis. Specifically, the study aims to:

1. Determine the extent to which the utilization of AI tools enhances students' interest in learning Basic Science in secondary schools within Makurdi Metropolis.
2. Determine the extent to which the utilization of AI tools enhances students' engagement in learning Basic Science in secondary schools within Makurdi Metropolis.

Research Questions

The following research questions guided the study:

1. To what extent does the utilization of AI tools enhance students' interest in learning Basic Science in secondary schools within Makurdi Metropolis?
2. To what extent does the utilization of AI tools enhance students' engagement in learning Basic Science in secondary schools within Makurdi Metropolis?

Hypotheses

The following null hypothesis was tested at 0.05 level of significance:

1. There is no significant impact of the utilization of AI tools on students' interest in learning Basic Science in secondary schools within Makurdi Metropolis.
2. There is no significant impact of the utilization of AI tools on students' engagement in learning Basic Science in secondary schools within Makurdi Metropolis.

Review of Related Literature

This study is anchored on the Constructivist Learning Theory (Piaget, 1973) and Self-Determination Theory (SDT) developed by Deci and Ryan (1985). (Piaget 1973), emphasized that learners actively construct knowledge through interaction with their environment rather than passively receiving information. Piaget identified stages of cognitive development which include sensorimotor, preoperational, concrete operational, and formal operational stages. These stages describe how learners' thinking develops progressively through experience and interaction. Knowledge is constructed when learners engage with experiences, reflect on them, and integrate new information into existing cognitive structures known as schemata. In Basic Science education, this theory supports active problem-solving, exploration, experimentation, and discovery-based learning. Constructivist-based interaction increases curiosity because learners experience hands-on exploration of Basic Science concepts through visualization and experimentation. Therefore, the theory explains how AI tool utilization contributes to improved interest and engagement in Basic Science learning. Similarly, Self-Determination Theory by Deci and Ryan (1985). Explains human motivation based on three psychological needs which are autonomy, competence, and relatedness. Autonomy refers to the need to feel in control of one's learning actions, competence refers to the need to feel capable and effective in performing tasks, and relatedness refers to the need to feel connected to others and experience meaningful interaction. In AI-assisted Basic Science learning, these psychological needs are supported through intelligent digital platforms that provide personalized learning experiences. AI tools such as ChatGPT, Photomath, Microsoft Math Solver, Wolfram Alpha, Socratic, GeoGebra, Khan Academy, and Quizlet promote autonomy because students can learn independently, select practice problems, control their learning pace, and explore different solution methods without constant supervision. Thus, Self-Determination Theory provides a motivational explanation for why

effective utilization of AI tools may enhance students' interest and engagement.

Empirically, Offiah, et al, (2025) examined the utilization of AI-based tools in secondary school chemistry learning and their impact on students' academic engagement. The study adopted a descriptive survey design. The study found that AI-based tools are utilized in secondary school chemistry teaching and that AI tools are not frequently integrated into lessons. Moreover, AI tools encourage students to study outside the classroom, while AI also promotes active class participation. However the research gap identified by the researcher is that of the subject area and the geographical location, the formal was conducted in chemistry and enugu state which the present study will fill.

Okoye and Eze (2021) conducted a study on the impact of e-learning tools on students' engagement in science subjects in Anambra State, Nigeria. Descriptive survey research design was adopted. Findings revealed that the use of digital learning tools significantly increased classroom participation, attentiveness, collaboration, and overall engagement among students. However, the research focused on general e-learning tools rather than Artificial Intelligence-based platforms with adaptive feedback and personalized learning capabilities which the present study seeks to fill.

MATERIALS AND METHODS

Methodology

The study adopted a descriptive survey research design. The design was considered appropriate because it enabled the researcher to obtain quantitative information directly from students concerning their experiences, perceptions, and responses regarding the use of AI tools in Basic Science without manipulating the study variables. The population of the study comprised 83,500 senior secondary school students in 89 registered secondary schools, in the 2024/2025 academic session conducted by the (Benue State Ministry of Education, 2025). A sample of 300 students was selected from 10 secondary schools using a multistage sampling procedure. First, the 10 schools were selected through random sampling to provide fair representation of the secondary schools in the metropolis; thereafter, simple random sampling was used to select 300 students from the selected schools, giving eligible students an equal opportunity of participating in the study. Utilization of Artificial Intelligent Tools and Students' Interest and Engagement Questionnaire (UAISEEQ) was used. The items were structured on a four-point rating scale of Very High Extent (VHE), Moderate Extent (ME), Low Extent (LE), and Very Low Extent (VLE). Two experts in Science and mathematics Education, validated the items for clarity, relevance, adequacy, and alignment with the variables and objectives of the study. Their observations and recommendations were incorporated. The researcher administered the questionnaires to the selected students after obtaining permission from the relevant school authorities. The purpose of the study was explained to the respondents, and sufficient time was provided for them to complete the instrument. The completed questionnaires were collected immediately for analysis. The data obtained were analyzed using descriptive and inferential statistics. Mean scores were used to answer the research questions relating to the extent of AI tool utilization, students' interest, and engagement, Chi-square statistics were used to test the formulated hypotheses at the 0.05 level of significance. The decision rule was that a calculated Chi-square value greater than the critical value would lead to rejection of the null hypothesis, whereas a calculated value less than or equal to the critical value would result in retaining the null hypothesis.

Results

Research Question 1: To what extent does the utilization of Artificial Intelligence (AI) tools enhance students' interest in learning Basic Science in secondary schools within Makurdi Metropolis?

Table 1: Students' Interest in Learning Basic Science Using AI Tools

S/N	Items	VHE	HE	LE	VLE	$\bar{X}$	SD	Decision
1	Using AI tools makes Basic Science more interesting to me	56	187	30	27	2.63	0.79	HE
2	I enjoy learning Basic Science when I use AI-based applications	51	158	46	35	2.53	0.85	HE
3	AI tools increase my curiosity to explore more Basic Science topics	59	177	42	22	2.63	0.80	HE
4	AI tools motivate me to participate actively in Basic Science lessons	63	181	31	25	2.70	0.82	HE
5	I feel excited when solving Basic Science problems with the help of AI tools	70	150	52	28	2.63	0.87	HE
6	AI tools improve my confidence in understanding Basic Science concepts	57	135	80	28	2.46	0.86	LE
7	Learning Basic Science with AI tools makes the subject easier and more attractive to me	58	172	43	27	2.63	0.80	HE
	Cluster Mean / Cluster Standard Deviation					**2.60**	**0.83**	**HE**

(Key: mean range: 3.50–4.00 = VHE; 2.50–3.49 = HE; 1.50–2.49 = LE; 1.00–1.49 = VLE)

Table 1 show that the utilization of Artificial Intelligence (AI) tools enhances students' interest in learning Basic Science to a high extent in secondary schools within Makurdi Metropolis. This is indicated by the cluster mean of 2.60 and cluster standard deviation of 0.83, which falls within the high extent (HE) range of 2.50–3.49. Specifically, students reported that AI tools motivate them to participate actively in Basic Science lessons $\bar{x}$ = 2.70 (SD = 0.82), make the subject more interesting $\bar{x}$ = 2.63, (SD = 0.79), increase their curiosity to explore more topics, $\bar{x}$ = 2.63 (SD = 0.80), and make learning easier and more attractive, $\bar{x}$ = 2.63 (SD = 0.80). However, the item on improving students' confidence in understanding Basic Science concepts recorded a low extent, $\bar{x}$ = 2.46 (SD = 0.86). Generally, Artificial Intelligence tools have a high extent of impact on students' interest in learning Basic Science

Research Question 2: To what extent does the utilization of Artificial Intelligence tools enhance students' engagement in learning Basic Science in secondary schools within Makurdi Metropolis?

Table 2: Students' Engagement in Learning Basic Science Using AI Tools

S/N	Items	VHE	HE	LE	VLE	Mean ($\bar{x}$)	SD	Decision
1	I actively participate in Basic Science tasks when using AI tools.	58	120	62	60	2.59	0.99	HE
2	AI tools increase the time I spend practicing Basic Science problems.	48	140	63	49	2.62	0.92	HE
3	I concentrate better on Basic Science assignments when using AI tools.	76	116	69	39	2.76	0.96	HE
4	AI tools encourage me to attempt difficult Basic Science questions.	99	111	48	42	2.89	0.96	HE
5	I complete Basic Science assignments more effectively with AI assistance.	107	115	49	29	3.00	0.92	HE
6	AI tools improve my critical thinking when solving Basic Science problems.	93	137	35	30	2.98	0.85	HE
7	I regularly engage with AI tools to improve my understanding of Basic Science.	87	144	35	34	2.95	0.87	HE
	Cluster Mean / Cluster Standard Deviation					2.83	0.92	HE

Key (Mean Range): 3.50–4.00 = VHE; 2.50–3.49 = HE; 1.50–2.49 = LE; 1.00–1.49 = VLE

Table 2 indicates that the utilization of Artificial Intelligence (AI) tools enhances students' engagement in learning Basic Science to a high extent in secondary schools within Makurdi Metropolis. This is supported by the cluster mean of 2.83 and cluster standard deviation of 0.92, which falls within the high extent (HE) range of 2.50–3.49. The item-by-item results show that students reported a high level of engagement across all the measured areas. The highest mean score for completing Basic Science assignments more effectively with AI assistance $\bar{x}$ = 3.00 (SD = 0.92), followed by improved critical thinking when solving Basic Science problems $\bar{x}$ = 2.98, (SD = 0.85) and regular engagement with AI tools to improve understanding of Basic Science $\bar{x}$ = 2.95, (SD = 0.87). Students also indicated that AI tools encourage them to attempt difficult questions $\bar{x}$ = 2.89, (SD = 0.96). Help them concentrate better on assignments, $\bar{x}$ = 2.76, (SD = 0.96). The lowest mean was recorded for active participation in Basic Science tasks when using AI tools, $\bar{x}$ = 2.59, (SD = 0.99), although this still falls within the high extent category. Generally, Artificial Intelligence tools have a high extent of impact on students' engagement in learning Basic Science.

Hypothesis 1: There is no significant impact of the utilization of AI tools on students' interest in learning Basic Science.

Table 3: Chi-Square Test for Utilization of Artificial Intelligence Tools and Students' Interest in Learning Basic Science

Responses	Observed	Expected	X^2	Df	P-value	Decision
VHE	56	75				
HE	187	75				
LE	30	75	**18.42**	**3**	**0.000**	**H_{01} is Rejected**
VLE	27	75				
Total	**300**	**300**				

Table 3 shows that there is a significant impact of the utilization of AI tools on students' interest in learning Basic Science [(X^2) =18.42, P-value =0.000<0.005]. This implies that the null hypothesis which states that there is no significant impact of AI tools on student's interest in learning Basic Science is rejected. This means that students who make use of AI tools tend to show increased curiosity, motivation, and enthusiasm toward learning Basic Science.

Hypothesis 2: There is no significant impact of the utilization of AI tools on students' engagement in learning Basic Science

Table 4: Chi-Square Test for Utilization of Artificial Intelligence Tools and Students' Engagement in Learning Basic Science

Responses	Observed	Expected	Df	X^2	P-value	Decision
VHE	58	75				
HE	120	75				
LE	62	75	**3**	**22.67**	**0.000**	**H_{02} is Rejected**
VLE	60	75				
Total	**300**	**300**				

Table 4 shows that there is a significant impact of the utilization of AI tools on students' engagement in learning Basic Science [(X^2) =22.67, P-value =0.000<0.005]. This implies that the null hypothesis which states that there is no significant impact of AI tools on student's engagement in learning Basic Science is rejected. This means that students who frequently use AI tools participate more actively, spend more time practicing Basic Science problems, and demonstrate better concentration during learning activities.

Discussion of Findings

The findings of this study revealed that Artificial Intelligence tools enhance students' interest in learning Basic Science to a high extent (Cluster Mean = 2.60, SD = 0.83). The finding shows that AI tools make

Basic Science more interesting, increase students' curiosity, motivate active participation, and make the subject easier and more attractive to learners. However, the finding also revealed that AI tools improve students' confidence in understanding Basic Science concepts only to a low extent ($\bar{x} = 2.46$). The finding is supported by Offiah et al. (2025), who reported that AI-based tools encourage students to study beyond the classroom and promote active participation in Chemistry learning. Similarly, Okoye and Eze (2021) found that digital learning tools increased students' participation, attentiveness, and overall engagement in science subjects. The significant chi-square result ($\chi^2 = 18.42$, $p < .05$) further indicates that students' responses concerning interest were significantly associated with the utilization of AI tools. Therefore, the null hypothesis was rejected.

The finding also revealed that the utilization of AI tools enhances students' engagement in learning Basic Science to a high extent, with a cluster mean of 2.83 and standard deviation of 0.92. Specifically, AI tools help students complete assignments more effectively ($\bar{x} = 3.00$), improve critical thinking ($\bar{x} = 2.98$), encourage them to attempt difficult questions ($\bar{x} = 2.89$), and promote regular engagement with Basic Science learning ($\bar{x} = 2.95$). This finding supports the Constructivist Learning Theory, which views learning as an active process involving exploration, problem-solving, and interaction with learning resources. The finding also supports Self-Determination Theory, particularly the needs for autonomy and competence, because AI tools enable students to practise independently, receive assistance, and develop greater confidence in handling learning tasks. The finding agrees with Offiah et al. (2025), who found that AI-based tools promote active classroom participation and encourage students to study outside the classroom. It also corroborates Okoye and Eze (2021), who reported that digital learning tools improve classroom participation, attentiveness, collaboration, and overall student engagement in science subjects. The significant chi-square result ($\chi^2 = 22.67$, $p < .05$) indicates that students' engagement responses were significantly associated with the utilization of AI tools.

CONCLUSION

Based on the findings of the study, it is concluded that the utilization of Artificial Intelligence (AI) tools enhances students' interest and engagement in learning Basic Science in secondary schools within Makurdi Metropolis to a high extent. AI tools make Basic Science more interesting, increase students' curiosity and motivation, and encourage active participation. They also improve students' concentration, critical thinking, problem-solving, assignment completion, and regular involvement in learning activities. Therefore, effective integration of AI tools into Basic Science teaching and learning can contribute to improved learning experiences among secondary school students.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

Basic Science teachers should integrate AI tools such as ChatGPT, Socratic, Quizlet, and other appropriate educational applications into classroom teaching to stimulate students' interest and engagement. Schools should provide adequate digital facilities and internet access to enable students and teachers to use AI tools effectively during Basic Science lessons. Teachers should be trained in the effective use of AI tools so that they can guide students in using AI for learning, problem-solving, and critical thinking rather than merely copying answers.

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