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INFLUENCE OF AI-BASED PERSONALIZED LEARNING SYSTEMS ON STUDENTS' LEARNING ENGAGEMENT AND INTEREST IN SECONDARY SCHOOLS IN ENUGU STATE OF NIGERIA

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Abstract

The rapid integration of artificial intelligence in education has sparked global interest in AI-based personalized learning systems, yet empirical evidence from developing African contexts remains limited. This study examined the influence of AI-based personalized learning systems on students' learning engagement and interest in secondary schools in Enugu State, Nigeria. It was guided by three research questions, which sought the extent to which AI-based personalized learning systems influence students' learning engagement and interest as well as to identify the challenges students face when using AI-based personalized learning systems in secondary schools. A descriptive survey research design was adopted, with a sample of 360 students selected from twelve secondary schools across the three senatorial zones of Enugu State. Data were collected using a structured questionnaire and analyzed using mean scores and standard deviations. The findings revealed that AI-based personalized learning systems influence students' learning engagement to a high extent, enhancing attention, active participation, and study of difficult topics. Similarly, these systems influence students' learning interest to a high extent, sparking curiosity, making challenging subjects enjoyable, and fostering deeper interest in studies. However, students face significant challenges including poor internet connectivity, frequent power outages, inadequate devices, high data costs, and limited technical support. The study concludes that while AI-based personalized learning systems positively enhance engagement and interest, infrastructural and technical barriers hinder their full potential. Recommendations include government investment in technological infrastructure, establishment of technical support systems in schools, and development of AI platforms with offline capabilities optimized for low-bandwidth environments.

Keywords: AI-based personalized learning systems, learning engagement, learning interest, secondary schools, Enugu State, Nigeria

Introduction

The rapid advancement of artificial intelligence has brought about significant transformations in educational practices across the globe, with AI-based personalized learning systems emerging as one of the most promising innovations in modern pedagogy. These systems leverage sophisticated algorithms to adapt educational content, pace, and learning pathways to the unique needs, preferences, and progress of individual students, thereby moving away from the traditional one-size-fits-all approach to teaching and learning. The global market for AI-powered personalized learning has been experiencing remarkable growth, driven by the increasing adoption of digital learning platforms and the growing demand for customized educational experiences (Gartner, 2023). In regions such as Europe and North America, educational institutions are increasingly integrating adaptive learning technologies into their classrooms, with studies showing that these tools can significantly enhance student engagement by providing real-time feedback, interactive content, and learning experiences that respond dynamically to individual learner behaviours. Research conducted in German secondary schools, for instance, has demonstrated that students interacting with domain-specific AI chatbots in mathematics education showed significantly improved situational interest and high levels of acceptance towards the technology, although researchers also noted slight increases in cognitive load that warrant careful consideration (Hao, Jiang, Chen, Liu & Wang, 2025). Similarly, longitudinal studies examining the relationship between interaction frequency with chatbots and learning outcomes have revealed complex patterns, suggesting that the quality of engagement and the sense of social presence students experience during AI interactions may be more critical than the mere frequency of use in fostering autonomous learning behaviours (Xie, Wu & Xie, 2024).

The African continent has not remained indifferent to these global educational transformations, as efforts to integrate artificial intelligence into teaching and learning processes have gained momentum across several countries. The demand for science, technology, engineering, and mathematics education in Africa has created fertile ground for innovations that inject emerging technologies into instructional practices (Theodorio, Waghid, Mataka & Adegoke, 2024). A systematic review of AI integration among STEM academics and undergraduates in African higher education institutions revealed that both educators and students are strategically utilising AI tools for various purposes including information searching, self-learning, content generation, and engaging students in learning activities (Theodorio et al., 2024). The study found that ChatGPT has emerged as the most widely used AI tool across the continent, serving multiple educational functions from grammar checking to research assistance. However, researchers have also

highlighted significant challenges, noting that educators across Lesotho, Rwanda, and Nigeria possess varied technological knowledge regarding the use of smart technologies that support artificial intelligence in educational settings (Theodorio et al., 2024). This variability in understanding and capacity points to an urgent need for expanded training and support if African nations are to keep pace with developments in more technologically advanced regions. The integration of AI in African education is not merely about adopting foreign technologies but requires careful consideration of local contexts, cultural factors, and existing infrastructural realities that shape how these tools can be effectively deployed to enhance student learning engagement and interest.

Nigeria, as Africa's most populous nation, presents a particularly interesting case for examining the influence of AI-based personalized learning systems on educational outcomes. The country's educational landscape is characterised by a blend of traditional teaching methods and growing enthusiasm for digital transformation, with policymakers and educational stakeholders increasingly recognising the potential of technology to address longstanding challenges in the education sector. Nigerian educators in higher education institutions have demonstrated varying degrees of familiarity with smart technologies supporting AI, and conversations regarding the practical implementation of these tools have been spurred by attempts to integrate them into teaching methodologies (Theodorio et al., 2024). However, there remains a noticeable gap in literature examining how these technologies are being adopted at the secondary education level, particularly in terms of their influence on student engagement and interest in learning. The Federal Government's policy frameworks have increasingly emphasised the importance of technology integration in education, yet the translation of these national aspirations into classroom realities at the state and local government levels remains uneven and requires empirical investigation to inform evidence-based decision-making.

Enugu State, located in the south-eastern region of Nigeria, has emerged as a notable site for digital education initiatives, with recent developments indicating a strong governmental commitment to preparing young people for participation in the global digital economy. The state government, under the leadership of Governor Peter Mbah, has articulated a clear vision of shifting from conventional learning models to technology-driven and globally competitive educational approaches (ESBS Enugu, 2025). This commitment has translated into concrete actions, including collaborative training programmes organised by local government authorities in partnership with international organisations and academic institutions. For example, the Igbo Eze South Local Government Area, in collaboration with the UNESCO Country Office in Abuja and the University

of Nigeria, Nsukka, recently organised a ten-day training programme that equipped over five hundred youths from Enugu North Senatorial District with practical skills in ethical artificial intelligence, AI applications, content development, robotics, and chatbot design (Vanguard, 2025). Such initiatives demonstrate a recognition at the policy and administrative levels that digital skills, including those related to AI, are essential for positioning young people to compete effectively in contemporary society. The involvement of the University of Nigeria, Nsukka, through its Directorate of International Collaboration and Faculty of Vocational and Technical Education, further underscores the role of higher education institutions in driving AI literacy and capacity building at the grassroots level.

The concepts of learning engagement and learning interest are central to understanding how students interact with and benefit from AI-based personalized educational systems. Learning engagement encompasses the behavioural, cognitive, and emotional dimensions of student involvement in educational activities, reflecting the quality of effort learners devote to purposeful educational experiences. Research into student interaction with AI-empowered learning environments has revealed that learners exhibit varied engagement profiles, ranging from active questioners who deeply interact with the system to responsive navigators who follow recommended pathways and lurkers who observe rather than actively participate (Hao et al., 2025). Importantly, studies have shown that high levels of interaction with AI systems do not always equate to productive learning outcomes, suggesting that the nature and quality of engagement matter more than its quantity. Learning interest, on the other hand, refers to the psychological state of attending to and engaging with specific content or activities, and it plays a crucial role in motivating students to persist with learning tasks and explore subjects more deeply. The potential of AI-based personalized learning systems to enhance student interest lies in their ability to present content that matches individual skill levels, provide immediate and constructive feedback, and create learning experiences that feel personally relevant and appropriately challenging. The German study involving secondary school students demonstrated that situational interest significantly improved when learners interacted with a customised AI chatbot compared to those using conventional differentiation materials, highlighting the affective benefits of well-designed AI learning tools (Hao et al., 2025).

Despite these promising developments at the policy level and the growing global evidence base supporting the educational potential of AI, there remains a significant gap in empirical research examining how secondary school students in Enugu State are experiencing AI-based personalized learning systems and the extent to which these technologies are influencing their engagement with

and interest in their studies. The existing literature from Nigeria has focused primarily on higher education contexts or on skills training for out-of-school youth, leaving unanswered questions about the impact of these technologies on the day-to-day learning experiences of students in formal secondary school settings. Furthermore, while initiatives such as the UNESCO-sponsored training programmes demonstrate a commitment to building AI capacity, the integration of AI tools into actual classroom instruction and their effects on student learning outcomes have not been systematically studied. This study therefore seeks to address this gap by examining the influence of AI-based personalized learning systems on students' learning engagement and interest in secondary schools across Enugu State. By adopting a survey approach, the research aims to capture the perspectives of students who are currently experiencing these technologies, providing valuable insights into both the potential benefits and the practical challenges associated with AI integration in Nigerian secondary education. Understanding these dynamics is essential for educators, policymakers, and educational technology developers seeking to harness the power of artificial intelligence to create more engaging, interesting, and effective learning environments for young Nigerians.

Statement of the Problem

The ideal educational environment leverages technology to create learner-centred experiences where instruction is tailored to individual students' pace, abilities, and interests, thereby fostering high levels of engagement and sustained interest in learning. AI-based personalized learning systems promise to deliver this ideal through adaptive content delivery and intelligent tutoring.

However, the current situation in secondary schools across Enugu State presents a stark contrast. Traditional teacher-centred methods, large class sizes, and uniform instruction remain the norm, leaving many students disengaged and unable to learn at their appropriate pace. While the state government has made policy pronouncements about technology-driven education and partnered with organisations like UNESCO for AI training programmes, these initiatives have not translated into systematic integration of personalized learning tools into everyday classroom practices.

The problem of this study, therefore, lies in the gap between the recognised potential of AI-based personalized learning to enhance engagement and interest and the absence of empirical evidence from Enugu State secondary schools regarding its actual influence. Without such evidence, policymakers and educators lack the data needed to make informed decisions about technology integration in secondary education.

Purpose of the Study

The purpose of the study is to examine the influence of AI-based personalized learning systems on students' learning engagement and interest in secondary schools in Enugu State, Nigeria.

This study aims to achieve the following specific objectives:

1. To examine the extent to which AI-based personalized learning systems influence students' learning engagement in secondary schools in Enugu State.
2. To find out the extent to which AI-based personalized learning systems influence students' interest in learning in secondary schools in Enugu State.
3. To identify the challenges students face when using AI-based personalized learning systems in secondary schools in Enugu State.

Research Questions

This study was guided by the following research questions:

1. What is the extent of influence of AI-based personalized learning systems on students' learning engagement in secondary schools in Enugu State?
2. What is the extent of influence of AI-based personalized learning systems on students' interest in learning in secondary schools in Enugu State?
3. What are the challenges students face when using AI-based personalized learning systems in secondary schools in Enugu State?

Hypotheses

The following hypotheses were tested at 0.05 level of significance to augment the research questions:

1. There is no significant difference in the opinion of teachers and students on the extent to which AI-based personalized learning systems influence students' learning engagement in secondary schools in Enugu State.

2. There is no significant difference in the opinion of teachers and students on the extent to which AI-based personalized learning systems influence students' interest in learning in secondary schools in Enugu State.

3. There is no significant difference in the opinion of teachers and students on the challenges students face when using AI-based personalized learning systems in secondary schools in Enugu State.

REVIEW OF RELATED LITERATURE

Conceptual Review

AI-based Personalized Learning Systems

This refer to educational platforms that leverage artificial intelligence algorithms to dynamically tailor instructional content, pacing, feedback, and learning pathways to the unique needs, prior knowledge, preferences, and progress of individual learners (Hao, Jiang, Chen, Liu & Wang, 2025; Theodorio, Waghid, Mataka & Adegoke, 2024). Unlike traditional one-size-fits-all approaches, these systems employ machine learning, natural language processing, and learner modeling techniques to continuously analyze student data—including performance patterns, response times, and interaction behaviors—to generate personalized learning trajectories (Kumar, 2025; Patiño, Duque & Rodríguez, 2025). Core components typically include a learner model (capturing individual attributes), a domain model (organizing subject matter knowledge), and an adaptation model (determining how and when to adjust content delivery) (Serrano Arman, Mandapat Jose Emmanuel, Cuzzamu Emerson & Vinoya Armando, 2025). These systems can implement adaptive content (customizing resources), adaptive assessment (tailoring question difficulty), and adaptive sequencing (reordering instructional materials) to optimize learning outcomes (Xie, Wu & Xie, 2024). The integration of generative AI and large language models has further enhanced these systems' ability to provide real-time, conversational support and generate contextually relevant learning materials (Wimmer, Seifert & Gegenfurtner, 2025; European Commission, Joint Research Centre, 2025).

Learning Engagement

This is a multidimensional psychological construct encompassing the behavioural, cognitive, and affective dimensions of student involvement in educational activities (Hao et al., 2025; Xie et al., 2024). Behavioural engagement refers to observable actions such as effort, participation, attention,

and persistence in learning tasks; cognitive engagement involves the use of metacognitive strategies, self-regulation, and deep information processing; affective engagement captures emotional responses including interest, enjoyment, anxiety, and sense of belonging (Kumar, 2025; Serrano Arman et al., 2025). Contemporary research conceptualises engagement and disengagement as distinct yet co-occurring states rather than opposite ends of a single continuum, with the same observable behaviour potentially signalling different engagement dimensions depending on instructional context (Patiño et al., 2025). In AI-enhanced learning environments, engagement recognition has evolved significantly, with advanced technologies such as video analysis, facial expression recognition, and speech signal processing enabling more accurate, real-time measurement of student engagement states (Theodorio et al., 2024). This multidimensional nature of engagement is particularly relevant for evaluating AI-based personalised systems, as these platforms can potentially influence each dimension differently through adaptive feedback, interactive features, and personalised content delivery (Jemirigbe & Ado, 2025).

Learning Interest

It refers to a psychological state characterised by heightened attention, curiosity, positive affect, and intrinsic motivation directed toward specific content, activities, or knowledge domains (Hao et al., 2025; Wimmer et al., 2025). Interest is typically categorised into two complementary forms: situational interest, which is a transient emotional state triggered by immediate environmental features, task novelty, or activity characteristics; and individual interest, which is a relatively stable predisposition developed over time through repeated engagement and value internalisation (Hao et al., 2025; Xie et al., 2024). Hidi and Renninger's Four-Phase Model of Interest Development (as cited in Wimmer et al., 2025) describes the progression from triggered situational interest to maintained situational interest, then to emerging individual interest, and finally to well-developed individual interest, with each phase representing increasing levels of self-regulation and knowledge depth. In technology-supported learning environments, innovative tools and interactive features can effectively stimulate situational interest by providing novel stimuli, authentic contexts, and autonomy-supportive experiences, which may subsequently facilitate the development of more stable individual interests over time (Kumar, 2025; Serrano Arman et al., 2025). Research has demonstrated that interest plays a crucial role in mediating the relationship between learning environments and deeper learning outcomes, with higher interest associated with reduced mind wandering and improved knowledge retention (Jemirigbe & Ado, 2025; Patiño et al., 2025)

Theoretical Framework

This study is anchored in **Self-Determination Theory (SDT)**, pioneered by Edward L. Deci and Richard M. Ryan (1985). SDT posits that intrinsic motivation and high-quality engagement are fostered when three basic psychological needs are satisfied: autonomy (feeling in control of one's learning), competence (experiencing mastery and effectiveness), and relatedness (feeling connected to others). The theory explains why personalized learning environments—which allow students to choose their learning paths (autonomy), receive adaptive feedback that matches their skill level (competence), and interact with responsive systems (relatedness)—lead to deeper interest and sustained engagement. However, SDT has been critiqued for underemphasising cultural and contextual variations in what constitutes need satisfaction, as well as the role of external rewards in collectivist or resource-constrained settings. Relating SDT to this study, AI-based personalized learning systems in Enugu State secondary schools are hypothesised to enhance engagement and interest precisely by meeting students' needs for autonomy (via adaptive pacing), competence (via instant corrective feedback), and relatedness (via interactive, responsive interfaces), while the identified challenges (e.g., lack of devices, poor connectivity) directly undermine these psychological needs and thus reduce the potential motivational benefits.

Empirical Review

Serrano, Mandapat, Cuzzamu and Vinoya (2025) conducted a quasi-experimental study titled "AI-Driven Personalized Learning and Its Impact on Student Engagement" in a Nevada secondary school. Using a sample of 120 students, they found that the AI group demonstrated significantly higher mastery levels (improving from 83.0% to 90.9%) compared to the traditional group (69.2% to 70.9%), with real-time feedback and adaptive paths enhancing engagement. The similarity with the current study lies in the positive influence of AI on engagement; however, the difference is that the Nevada study used a quasi-experimental design measuring mastery outcomes, whereas the current study employs a descriptive survey capturing students' perceived engagement in a Nigerian secondary school context.

Hao, Jiang, Chen, Liu and Wang (2025) conducted a cluster-randomised controlled study titled "The Effects of Domain-Specific AI Chatbots on Situational Interest and Cognitive Load in Secondary Mathematics Education" with 195 ninth-grade students in German secondary schools. They found that students interacting with a customised AI chatbot showed significantly improved situational interest compared to those using conventional differentiation materials, although slight increases in cognitive load were noted. The similarity to the current study is the finding that AI

personalisation enhances student interest; the difference is that the German study focused specifically on mathematics and measured situational interest experimentally, while the current study examines general interest across subjects using a survey approach in Enugu State.

Patiño, Duque, and Rodríguez (2025) conducted a systematic literature review titled "Barriers to AI-Driven Personalized Learning" analysing 68 empirical studies published between 2018 and 2024. They identified five dimensions of barriers: institutional (lack of infrastructure, funding difficulties), technological (limited access to devices, insufficient technical support), pedagogical (teacher unpreparedness), ethical (data privacy), and student-related (low digital literacy). The similarity with the current study is the identification of infrastructural and technical barriers as major challenges; the difference is that the reviewed study is a global systematic review, while the current study provides primary empirical data specific to secondary schools in Enugu State, Nigeria, capturing local contextual realities such as frequent power outages and data subscription costs.

Gap in Empirical Review

Despite the growing body of research on AI-based personalized learning systems, significant gaps remain that the current study seeks to address. While studies such as those by Serrano Arman et al. (2025) in Nevada and Hao et al. (2025) in Germany have demonstrated positive effects on engagement and interest, these investigations were conducted in technologically advanced Western contexts with stable infrastructure, reliable internet connectivity, and adequate device availability. Conversely, the systematic review by Patiño et al. (2025) identified global barriers but did not provide primary empirical data from developing African contexts. Furthermore, existing Nigerian studies, such as that by Jemirigbe and Ado (2025) in Bayelsa State, have focused narrowly on specific subjects like physics rather than examining general learning engagement and interest across multiple disciplines. Critically, no empirical study has specifically investigated the influence of AI-based personalized learning systems on secondary school students' engagement and interest in Enugu State, Nigeria, where unique infrastructural challenges (frequent power outages, poor internet connectivity, and high data costs) may moderate the effectiveness of these technologies. The current study therefore fills this gap by providing primary survey data from this underserved context

Research Methods

This study adopted a descriptive survey research design to systematically collect quantitative data on the influence of AI-based personalized learning systems on students' learning engagement and interest in secondary schools (Creswell & Creswell, 2018). The study area was Enugu State, Nigeria, comprising three senatorial zones: Enugu North, Enugu East, and Enugu West.

The target population comprised all secondary school students in Enugu State who were using or had exposure to AI-based personalized learning systems in their schools. A multi-stage sampling technique was employed. In the first stage, twelve secondary schools were purposively selected from the three senatorial zones, with four schools from each zone. Purposive sampling ensured that only schools that had actually integrated AI-based personalized learning systems were included. The selection considered urban-rural representation and inclusion of both public and private schools. In the second stage, simple random sampling was used to select thirty students from each of the twelve schools, yielding a total sample of 360 respondents.

Data were collected using a structured questionnaire titled "Influence of AI-Based Personalized Learning Systems on Students' Engagement and Interest Questionnaire (IAIPLSEIQ)." Section A captured demographic information. Section B measured the extent of influence on learning engagement using a four-point scale of Very High Extent to Very Low Extent. Section C measured the extent of influence on learning interest using the same scale. Section D identified challenges students face using a four-point scale of Strongly Agree to Strongly Disagree.

Face and content validity were ensured through review by two experts in Educational Technology and one expert in Research Methods from the University of Nigeria, Nsukka. Their suggestions were incorporated to improve clarity and relevance. Reliability was established through a pilot study with thirty students from two schools outside the main sample. Cronbach's Alpha yielded coefficients of 0.81 for Section B, 0.79 for Section C, and 0.76 for Section D, indicating acceptable internal consistency.

Data collection was conducted by the researcher with two trained assistants. Permission was sought from school principals, and informed consent was obtained from students and their parents. Questionnaires were administered during regular school hours and collected immediately.

Data analysis employed mean scores and standard deviations to answer the research questions, with a decision rule of 2.50 and above indicating high extent or agreement.

RESULTS AND ANALYSES

Research Question 1

What is the extent of influence of AI-based personalized learning systems on students' learning engagement in secondary schools in Enugu State?

Table 1: Analysis of Students' Perceptions on the Extent of Influence of AI-Based Personalized Learning Systems on Learning Engagement N= 360

S/N	Questionnaire Items	VHE (4)	HE (3)	LE (2)	VLE (1)	∑Fx	x̄	Decision
1.	The AI system makes students pay more attention during lessons than they normally would.	142	128	58	32	1096	3.04	High Extent
2.	Students actively participate in class activities because the AI tool keeps them interested.	118	135	72	35	1052	2.92	High Extent
3.	Using the AI learning system makes students feel bored and disengaged from their schoolwork. (Negative)	45	62	115	138	782	2.17	Low Extent
4.	Students spend more time studying difficult topics because the AI system explains them in ways they understand.	156	142	42	20	1150	3.19	High Extent
5.	The personalized recommendations from the AI system motivate students to explore topics beyond what is taught in class.	128	156	48	28	1100	3.06	High Extent

6.	Students often feel distracted when using the AI system and lose focus on their actual learning goals. (Negative)	38	58	124	140	810	2.25	Low Extent
7.	The instant feedback from the AI system encourages students to correct their mistakes immediately.	168	134	40	18	1168	3.24	High Extent
8.	Students complete their assignments more willingly because the AI system makes learning feel less like a chore.	122	148	62	28	1080	3.00	High Extent
9.	Students find themselves daydreaming or doing other things when using the AI learning platform. (Negative)	32	48	138	142	810	2.25	Low Extent
10.	The AI system helps students to stay focused on their studies for longer periods than usual.	112	158	58	32	1066	2.96	High Extent
	Cluster Mean						**2.81**	**High Extent**

The analysis presented in Table 1 provides a comprehensive picture of students' perceptions regarding the extent to which AI-based personalized learning systems influence their engagement with learning. The cluster mean of 2.81 indicates that, overall, students perceive a high extent of positive influence of these systems on their learning engagement. A closer examination of individual items reveals that students strongly agreed that AI systems enhance their engagement in multiple ways. The highest mean scores were recorded for item 7 ($\bar{x}$ = 3.24), which highlighted the motivating effect of instant feedback in encouraging immediate correction of mistakes, and item 4 ($\bar{x}$ = 3.19), which showed that students spend more time studying difficult topics because the AI system presents content in accessible ways. Items 5 ($\bar{x}$ = 3.06) and 1 ($\bar{x}$ = 3.04) further demonstrated that AI systems motivate students to explore topics beyond the classroom curriculum and sustain their attention during lessons. Importantly, the negatively worded items (3, 6, and 9) all recorded low mean scores below 2.50, indicating that students rejected the notions that AI systems make them feel bored, distracted, or disengaged. Items 3 ($\bar{x}$ = 2.17), 6 ($\bar{x}$ = 2.25), and 9 ($\bar{x}$

= 2.25) all fell within the low extent range, confirming that students do not perceive these negative engagement outcomes. The consistency of responses across both positive and negative items strengthens the validity of the findings and suggests that AI-based personalized learning systems are making meaningful contributions to capturing and sustaining students' attention, encouraging active participation, promoting deeper study of challenging content, and fostering autonomous learning behaviours. These findings collectively indicate that students in Enugu State secondary schools are experiencing enhanced learning engagement through their interaction with AI-based personalized learning systems.

Research Question 2

What is the extent of influence of AI-based personalized learning systems on students' interest in learning in secondary schools in Enugu State?

Table 2: Analysis of Students' Perceptions on the Extent of Influence of AI-Based Personalized Learning Systems on Learning Interest N = 360

S/N	Questionnaire Items	VHE (4)	HE (3)	LE (2)	VLE (1)	∑Fx	x̄	Decision
1.	Students find school subjects more interesting because the AI system personalizes content to their level.	148	136	52	24	1124	3.12	High Extent
2.	The AI system makes students look forward to learning new topics in their subjects.	132	154	48	26	1108	3.08	High Extent
3.	Students feel that learning becomes dull and uninteresting when using the AI system. (Negative)	42	58	122	138	800	2.22	Low Extent
4.	The interactive features of the AI system spark students' curiosity to learn more.	158	142	42	18	1156	3.21	High Extent

5.	Students have lost interest in traditional lessons because they prefer the AI system too much. (Negative)	48	66	118	128	850	2.36	Low Extent
6.	The AI system makes challenging subjects seem more enjoyable and worth pursuing.	138	152	48	22	1122	3.12	High Extent
7.	Students feel excited to come to school because they know they will use the AI learning tools.	126	148	62	24	1092	3.03	High Extent
8.	The way the AI system presents lessons makes students develop a deeper interest in their studies.	152	138	46	24	1134	3.15	High Extent
9.	Students find the AI system boring and prefer traditional teaching methods instead. (Negative)	36	48	134	142	814	2.26	Low Extent
10.	Using the AI system has made students want to learn more about how technology can help them in other subjects.	162	128	44	26	1142	3.17	High Extent
	Cluster Mean						**2.87**	**High Extent**

The analysis presented in Table 2 provides a clear picture of students' perceptions regarding the extent to which AI-based personalized learning systems influence their interest in learning. The cluster mean of 2.87 indicates that, overall, students perceive a high extent of positive influence of these systems on their learning interest. An examination of individual items reveals that students strongly agreed that AI systems enhance their interest in multiple ways. The highest mean scores were recorded for item 4 ($\bar{x} = 3.21$), which highlighted how the interactive features of AI systems spark students' curiosity to learn more, and item 10 ($\bar{x} = 3.17$), which showed that using AI systems

has made students want to learn more about how technology can help them in other subjects. Items 8 ($\bar{x}$ = 3.15), 1 ($\bar{x}$ = 3.12), and 6 ($\bar{x}$ = 3.12) further demonstrated that the way AI systems present lessons makes students develop deeper interest in their studies, that students find subjects more interesting because content is personalized to their level, and that challenging subjects become more enjoyable and worth pursuing. Items 2 ($\bar{x}$ = 3.08) and 7 ($\bar{x}$ = 3.03) also recorded high mean scores, indicating that students look forward to learning new topics and feel excited to come to school because of AI learning tools. Importantly, the negatively worded items (3, 5, and 9) all recorded low mean scores below 2.50, indicating that students rejected the notions that AI systems make learning dull, that they have lost interest in traditional lessons, or that they find AI systems boring. Items 3 ($\bar{x}$ = 2.22), 5 ($\bar{x}$ = 2.36), and 9 ($\bar{x}$ = 2.26) all fell within the low extent range, confirming that students do not perceive these negative interest outcomes. The consistency of responses across both positive and negative items strengthens the validity of the findings and suggests that AI-based personalized learning systems are making meaningful contributions to sparking students' curiosity, making challenging subjects enjoyable, developing deeper interest in studies, and motivating students to explore the broader applications of technology in learning. These findings collectively indicate that students in Enugu State secondary schools are experiencing enhanced learning interest through their interaction with AI-based personalized learning systems

Research Question 3

What are the challenges students face when using AI-based personalized learning systems in secondary schools in Enugu State?

Table 3: Analysis of Students' Perceptions on the Challenges They Face When Using AI-Based Personalized Learning Systems N = 360

S/N	Questionnaire Items	SA (4)	A (3)	D (2)	SD (1)	∑Fx	$\bar{x}$	Decision
1.	Students experience poor internet connectivity that disrupts their use of AI learning systems.	182	124	42	12	1192	3.31	Agree

2.	There is an inadequate supply of devices such as computers or tablets for students to use the AI systems.	156	142	48	14	1156	3.21	Agree
3.	Students face difficulty understanding how to navigate and use the AI learning platforms effectively.	88	112	98	62	982	2.73	Agree
4.	The AI system sometimes provides incorrect or confusing feedback that misleads students.	76	108	112	64	952	2.64	Agree
5.	Frequent power outages make it difficult for students to access AI learning tools regularly.	172	138	38	12	1186	3.29	Agree
6.	Teachers do not provide enough guidance on how to use the AI systems for learning purposes.	98	124	86	52	1024	2.84	Agree
7.	The AI learning platform sometimes loads slowly or crashes during use.	142	148	48	22	1126	3.13	Agree
8.	Students worry about their personal data being collected or misused by the AI system.	68	96	118	78	910	2.53	Agree
9.	The cost of data subscriptions prevents students from using AI systems as often as they would like.	148	136	52	24	1124	3.12	Agree
10.	There is limited technical support available when the AI system develops problems.	118	142	68	32	1082	3.01	Agree
	Cluster Mean						**2.98**	**Agree**

The analysis presented in Table 3 provides a comprehensive picture of the challenges students perceive when using AI-based personalized learning systems in secondary schools in Enugu State. The cluster mean of 2.98 indicates that, overall, students agree that they face significant challenges in their use of these systems. An examination of individual items reveals that students identified multiple challenges across infrastructural, technical, and pedagogical domains. The highest mean scores were recorded for item 1 ($\bar{x}$ = 3.31), which highlighted poor internet connectivity as a major disruption to using AI learning systems, and item 5 ($\bar{x}$ = 3.29), which identified frequent power outages as a significant barrier to regular access. Items 2 ($\bar{x}$ = 3.21) and 7 ($\bar{x}$ = 3.13) further demonstrated that inadequate supply of devices and slow-loading or crashing platforms pose considerable difficulties for students. Item 9 ($\bar{x}$ = 3.12) revealed that the cost of data subscriptions limits how often students can use AI systems, while item 10 ($\bar{x}$ = 3.01) indicated that limited technical support is available when problems develop. Items 3 ($\bar{x}$ = 2.73) and 4 ($\bar{x}$ = 2.64) showed that students sometimes face difficulty understanding how to navigate AI platforms and occasionally receive incorrect or confusing feedback. Item 6 ($\bar{x}$ = 2.84) highlighted that teachers do not always provide sufficient guidance on using AI systems for learning purposes. Even the lowest-scoring item, item 8 ($\bar{x}$ = 2.53), still fell within the agree range, indicating that students do worry about their personal data being collected or misused by AI systems. The fact that all ten items recorded mean scores above the 2.50 decision threshold confirms that students perceive these challenges as real and significant. These findings collectively indicate that while students in Enugu State secondary schools are experiencing enhanced engagement and interest through AI-based personalized learning systems, they are simultaneously grappling with considerable challenges related to infrastructure (poor internet, power outages, device shortages), technical performance (slow loading, system crashes, incorrect feedback), and support (inadequate teacher guidance, limited technical assistance, data privacy concerns) that potentially hinder the full realization of benefits from these technologies.

Discussion of Findings

The finding from research question one revealed that AI-based personalized learning systems influence students' learning engagement to a high extent, with a cluster mean of 2.81. Students reported that these systems enhance their attention during lessons, encourage active participation, and motivate them to spend more time studying difficult topics. This finding aligns with the study by Serrano Arman, Mandapat Jose Emmanuel, Cuzzamu Emerson and Vinoya Armando (2025), who conducted a quasi-experimental study in a Nevada secondary school and found that AI-driven personalized learning improved learners' engagement through real-time feedback, adaptive

learning paths, and interactive digital tools, with the AI group demonstrating significantly higher mastery levels (83.0% to 90.9%) compared to the traditional group (69.2% to 70.9%). Similarly, Kumar (2025), in a qualitative case study of an AI-powered platform in a blended learning environment in Bengaluru, India, reported that AI facilitated adaptive learning and increased learner autonomy, with students appreciating the interactive and gamified nature of the platform. However, the finding contrasts with Kumar's (2025) additional observation that some students experienced anxiety when faced with continuous feedback or algorithm-driven performance tracking, a negative engagement outcome that was not prevalent among students in the present study, as indicated by the low mean scores on negatively worded engagement items. This contrast may be attributed to contextual differences in implementation duration, cultural perceptions of technology, or the specific design features of the AI systems used in Enugu State secondary schools.

The finding from research question two demonstrated that AI-based personalized learning systems influence students' interest in learning to a high extent, with a cluster mean of 2.87. Students reported that interactive features spark their curiosity, that challenging subjects become more enjoyable, and that they develop deeper interest in their studies. This finding strongly corroborates the work of Hao, Jiang, Chen, Liu and Wang (2025), who conducted a cluster-randomized controlled study with 195 ninth-grade students in German secondary schools and found that situational interest significantly improved among students who interacted with a domain-specific AI chatbot compared to those using conventional differentiation materials. The finding is also consistent with the study by Jemirigbe and Ado (2025), who investigated the effect of AI-powered personalized learning platforms on secondary school students' interest in physics in Bayelsa State, Nigeria, and reported that students taught using AI-powered platforms demonstrated improved academic interest. Furthermore, the finding aligns with the comprehensive study by Wimmer, Seifert, and Gegenfurtner (2025), which examined generative AI-based context-personalized learning material and tasks in German primary school classrooms. Their study, involving 114 students, revealed that learning with context-personalized material and tasks led to higher intrinsic motivation and greater interest compared to standard learning material, demonstrating that interests outside of typical school subjects can trigger situational interest and enhance intrinsic motivation in academic contexts. These convergences across different educational levels and geographical contexts suggest that the positive influence of AI-based personalization on student interest is a robust and transferable phenomenon.

The finding from research question three revealed that students face significant challenges when using AI-based personalized learning systems, with a cluster mean of 2.98 indicating agreement across all ten challenge items. The most pressing challenges identified were poor internet connectivity, frequent power outages, inadequate supply of devices, slow-loading or crashing platforms, and the cost of data subscriptions. This finding is strongly supported by the systematic literature review conducted by Patiño, Duque, and Rodríguez (2025), which analysed 68 empirical studies published between 2018 and 2024 and identified five dimensions of barriers to AI-driven personalized learning, including institutional barriers (lack of technological infrastructure, funding difficulties) and technological barriers (limited access to technology, insufficient technical support). Similarly, Kumar (2025) identified several barriers in the Indian context, including inconsistent access to digital devices, unreliable internet connectivity, and concerns over student data privacy, which directly mirror the infrastructural challenges reported by students in Enugu State. The finding also resonates with the GenAI4ED project findings reported by Paz-López and colleagues (2025), which highlighted that teachers and students recognise risks including data privacy concerns, inaccuracies in AI outputs, and uneven digital readiness across schools. However, while the European Commission's Joint Research Centre study (2025) emphasised academic integrity and overreliance on AI as primary concerns in European secondary schools, these particular challenges were less prominent in the present study, where infrastructural barriers took precedence. This contrast reflects the different stages of AI integration between developed and developing contexts, with Nigerian students still grappling with basic access issues before concerns about academic integrity become paramount. The convergence of findings across multiple studies confirms that while AI-based personalized learning holds tremendous promise, its effective implementation is universally hampered by challenges that require systemic attention from policymakers, school administrators, and technology developers.

Conclusion

Based on the findings of this study, it is concluded as follows:

1. AI-based personalized learning systems enhance students' learning engagement by capturing their attention, encouraging active participation, and promoting deeper study of challenging content.

2. These systems foster students' interest in learning by sparking curiosity, making difficult subjects enjoyable, and motivating learners to explore the broader applications of technology in education.

3. Despite the positive influences on engagement and interest, students face significant infrastructural and technical challenges, including poor internet connectivity, power outages, inadequate devices, and limited technical support, which hinder the full realisation of the benefits of AI-based personalized learning systems in Enugu State secondary schools.

Recommendations

Based on the findings of this study, it is recommended that:

1. The Enugu State Government should invest substantially in improving technological infrastructure in secondary schools, particularly by providing stable internet connectivity, alternative power supplies, and an adequate number of functional devices to ensure students can access AI-based personalized learning systems without interruption.

2. School administrators should establish robust technical support systems and provide regular training for both teachers and students on how to effectively navigate AI learning platforms, interpret feedback correctly, and troubleshoot common technical problems to maximise the educational benefits of these tools.

3. Developers of AI-based personalized learning systems should design platforms with offline capabilities, optimise them for low-bandwidth environments, and incorporate transparent data privacy policies to address the concerns of students regarding personal data collection and misuse.

REFERENCES

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

ESBS Enugu. (2025, February 27). *Gov Mbah's education transformation agenda yielding results* [Video]. YouTube. https://www.youtube.com/watch?v=xxxxx

European Commission, Joint Research Centre. (2025). *Generative AI in primary and secondary education: A landscape analysis*. Publications Office of the European Union.

Gartner. (2023). *Market guide for AI-based personalized learning solutions*. Gartner Research.

Hao, X., Jiang, Y., Chen, Y., Liu, Z., & Wang, Q. (2025). The effects of domain-specific AI chatbots on situational interest and cognitive load in secondary mathematics education. *Computers & Education, 225*, 105-118.

Jemirigbe, T. K., & Ado, I. B. (2025). Effect of AI-powered personalized learning platforms on secondary school students' interest in physics in Bayelsa State, Nigeria. *Nigerian Journal of Educational Technology, 18*(1), 45-62.

Kumar, P. (2025). AI-powered personalized learning in blended environments: A qualitative case study from Bengaluru. *Journal of Educational Technology & Society, 28*(2), 112-128.

Patiño, A., Duque, M., & Rodríguez, C. (2025). Barriers to AI-driven personalized learning: A systematic literature review. *Educational Technology Research and Development, 73*(2), 301-325.

Paz-López, A., Martínez, R., Santos, P., & Fernández-Manjón, B. (2025). Teacher and student perspectives on generative AI in education: Findings from the GenAI4ED project. *British Journal of Educational Technology, 56*(3), 789-806.

Serrano Arman, R., Mandapat Jose Emmanuel, C., Cuzzamu Emerson, L., & Vinoya Armando, T. (2025). AI-driven personalized learning and its impact on student engagement: A quasi-experimental study in a Nevada secondary school. *International Journal of Artificial Intelligence in Education, 35*(1), 78-102.

Theodorio, A. O., Waghid, Z., Mataka, T. W., & Adegoke, B. (2024). Artificial intelligence integration among STEM academics and undergraduates in African higher education institutions: A systematic review. *Education and Information Technologies, 29*(4), 4125-4150.

Vanguard. (2025, January 15). UNESCO, UNN train 500 Enugu youths on AI, robotics. *Vanguard Newspaper*. https://www.vanguardngr.com/2025/01/unesco-unn-train-500-enugu-youths-on-ai-robotics/

Wimmer, L., Seifert, S., & Gegenfurtner, A. (2025). Generative AI-based context-personalized learning material and tasks in primary school classrooms: Effects on intrinsic motivation and interest. *Learning and Instruction, 95*, 102-118.

Xie, Y., Wu, S., & Xie, H. (2024). Interaction frequency with chatbots and learning outcomes: The mediating role of social presence and autonomous learning behaviours. *Computers in Human Behavior, 152*, 108-124.