

# Revolutionizing Education with Artificial Intelligence and Machine Learning: Personalization, Retention, and Resource Optimization

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## Abstract

*The potency of AI and ML in global educational development is evidenced by their ability to provide adaptive learning platforms that cater to the unique needs of each student, thereby significantly enhancing learning outcomes and fostering academic success. AI-driven analytics and predictive modeling are empowering educators to identify at-risk students early and implement targeted interventions, ultimately improving retention rates and ensuring that more students reach their full potential. However, the integration of AI and ML has not been fully employed for personalization; retention; resource optimization in the developing nations like Nigeria. **Aim:** This study explores the transformative role of Artificial Intelligence (AI) and Machine Learning (ML) in enhancing personalization, retention, and resource optimization through reinforcement learning among Nigerian higher education. The study investigated and answered 5 research questions using a It focused on the effectiveness of AI and ML tools in personalizing learning experiences, improving student retention through predictive analytics, and optimizing resource management. **Method:** descriptive design of the survey approach was employed for this study. Descriptive (frequency counts, percentages, means and standard deviation) statistical instruments were used to analyzed quantitative data that were collected. **Results:** The findings suggest that AI and ML enhance personalized learning, streamline administrative processes, and foster an inclusive and innovative academic environment, ultimately improving educational outcomes in Nigerian tertiary institutions. The study recommends that more resources should be allocated for procuring AI and ML technologies; and establishes intensive and continuous workshop and seminars programs for both students and educators on how to effectively utilize these tools in influencing pedagogic experiences.*

**Keywords:** Artificial Intelligence; Machine Learning; Personalization; Retention; Resource Optimization

## 1. Introduction

The global educational trends in progression towards technology-driven learning environments are increasingly emphasizing the deployment and integration of Artificial Intelligence (AI) and Machine Learning (ML) into higher education. Artificial intelligence (AI) is a branch of computer science and software that emphasizes on the creation of systems or machines that is capable of performing tasks that would require human intelligence. Ahmad, Mustapha and Ahmad (2024) described AI as computers' ability to perform cognitive functions, such as perceiving, reasoning, and learning and problem-solving, that are usually associated with human minds. AI perform tasks like learning from data, reasoning, problem-solving, perception, understanding natural language, and making decisions (McKinsey Global Institute, 2022). According to Russell and Norvig (2012), AI is the study of agents that receive percepts from the environment and perform tasks that require human-like cognitive functions such as understanding, learning, reasoning, and interacting; solve complex problems by training models on large datasets, allowing systems to learn representations of data at multiple levels of abstraction (Goodfellow, Bengio, & Courville (2022); and systems that employ algorithms and computational models to perform tasks that typically require human intelligence, including visual perception, speech recognition, decision-making, and language translation (Stanford University, 2023). Also, Tiwari, Tiwari and Tiwari (2018) defined Machine Learning as a branch of artificial intelligence that allows computer systems to learn directly from examples, data, and

experience. Through enabling computers to perform specific tasks intelligently, machine learning systems can carry out complex processes by learning from data, rather than following pre-programmed rules. Machine learning (ML) is a branch of artificial intelligence that involves the development of algorithms and statistical models enabling computers to perform tasks without explicit instructions. Recognizing the embedded unique transformative power of these technologies in given new shape to education, spur the growing awareness of AI and ML in fueling interests of researchers, educators and students to embrace these innovations in order to enhance pedagogic experiences. Despite gradual improvements in technological infrastructure, Odufuwa, and Salami (2021) attested to widespread adoption of AI and ML in Nigerian higher education to be gaining momentum recently; due to growing awareness (Adeoye & Alao, 2022) of the potential benefits of AI and ML in educational settings; government and educational institutions support (Eze & Chinedu-Eze, 2020) given in the recent years and increasing research and innovation (Oladejo & Olatunji, 2021) within Nigerian universities (Ibrahim & Musa, 2023) focusing on AI and ML integration into Nigerian education curricula and teaching methods. The integration of Artificial Intelligence (AI) and Machine Learning (ML) into higher education is poised to revolutionize teaching and learning processes in Nigerian universities. The goal of AI and ML is to empower machines with the ability to autonomously collect and process data from their environment in order to make decisions and solve problems, as well as to perform other tasks where human thought is required (Von Krogh, 2018; Gbaden, Gambo & Shem, 2024). These technologies offer personalized learning experiences, enhance student retention through predictive analytics, and optimize resource management, contributing to more efficient administrative operations (Olaleye & Oyewole, 2020). AI-powered language tools play a crucial role in supporting multilingual education, which is vital in a linguistically diverse nation like Nigeria (Adeyemi, 2021). The application of AI and ML in research and innovation accelerates academic progress by enabling advanced data analysis and pattern recognition (Nwachukwu, 2019). Nigerian universities face several educational challenges, including large class sizes, limited resources, and diverse linguistic backgrounds, which can hinder effective teaching and learning (Afolabi & Okebukola, 2020). Eze et al. (2021) found out that Artificial Intelligence (AI) and Machine Learning (ML) offers personalized learning experiences and adapting contents to meet the needs of individual students and thereby enhancing engagement and understanding. Subsequently, Ikechukwu and Nwankwo (2019) averred that predictive analytics enabled by AI and ML to identify students at risk of underperforming, thereby, facilitating timely interventions that would improve retention rates. According to Ogunde and Adeyemi (2022), resource optimization is another critical area where AI and ML can have a significant impact, streamlining administrative processes and ensuring efficient allocation of limited resources. AI-powered language tools play major roles in supporting multilingual education, thereby addressing the challenges posed by Nigeria's linguistic diversity (Adepoju, 2021). The integration of Artificial Intelligence (AI) and Machine Learning (ML) offers promising solutions to personalized learning experiences, tailoring content to individual student needs, thereby enhancing engagement and understanding (Eze et al., 2021). This personalized approach not only boosts understanding but also supports students from diverse linguistic backgrounds, an essential consideration in Nigeria's multilingual context (Adeyemi, 2021). Moreover, predictive analytics powered by AI and ML can identify students at risk of underperformance, enabling timely interventions that improve retention rates (Ikechukwu & Nwankwo, 2019). This proactive approach is crucial for enhancing student success and overall institutional effectiveness. AI and ML technologies optimize resource management, streamlining administrative operations and ensure efficient allocation of limited resources (Ogunde & Adeyemi, 2022). Moreover, AI-powered language tools are essential in supporting multilingual education, addressing the challenges posed by Nigeria's linguistic diversity (Adepoju, 2021). By facilitating advanced data analysis and fostering innovation, AI and ML also contribute to research advancements within academic institutions (Okoro & Agwu, 2020). However, these developments are poised with some perennial challenges.

## 2. Related Works

Myriads of literature reviewed substantiates the existence of some the challenges faced in many Nigerian universities as infrastructure limitations, lacking high-speed internet, computing resources, and updated software essential for AI and ML implementation (Adeyemo, 2020). Olabode (2021) found out the existence of significant skills gap with reference to shortage of qualified personnel to deploy and integrate AI and ML technologies; thereby hindering their urgent integration into the curriculum. Oluwadare (2019) attested to funding as one of the major constraints that further worsen this ugly scenario of integrating these technologies into pedagogic experiences. Limited financial resources allocated to AI and ML research and development restrict investment in necessary equipment and training programs within these institutions. Vis-à-vis the traditional curriculum in Nigerian universities, Adeyemo (2020), opined that such may not adequately incorporate AI and ML courses, thus, resulting in a mismatch between industry demands and educational offerings. According to Olabode (2021) data privacy and responsible AI use, is crucial for the ethical implementation of AI and ML in educational settings, hence, addressing regulatory and ethical concerns are should be paramount. Oluwadare (2019) further attested to notable lack of awareness among stakeholders about the potential benefits and applications of AI and ML in education, which impedes widespread adoption and integration efforts. Inconclusive findings on effective integration of AI and ML in personalizing learning experiences in Nigerian universities prompted the authors to carry out this study. Therefore, this study examined the potential of these technologies to transform higher education in Nigerian universities, addressing existing challenges and improving overall educational outcomes.

### 2.1 Statement of the Problem

The integration of Artificial Intelligence (AI) and Machine Learning (ML) in Nigerian universities presents both opportunities and challenges. Despite their potential to personalize learning experiences, many institutions struggle to effectively implement these technologies due to resource constraints (Afolabi, 2021). According to Olalere et al. (2020), there is critical continuous increased on the need for strategy to device in simplifying students' access and engagement with newer technologies to address diverse student needs in terms of education; which integration of AI and ML tools could do. Also, insufficient professional knowledge and development programs affect educators and students to fully utilize these technologies (Olayinka, 2021); for effective pedagogic experiences. A key component of AI called predictive analytics can significantly improve student retention by identifying at-risk individuals, yet its adoption remains limited (Nguyen et al., 2020). Streamlining administrative processes through AI can optimize resource management, but infrastructural challenges persist (Brynjolfsson & McAfee, 2017). Hence, the current educational landscape in Nigeria requires a strategic approach to fully harness the benefits of AI and ML (Baker & Smith, 2019). Afolabi (2021) attested to inadequate resources and trainings in harnessing the potentials that are embedded in integrating these technologies for pedagogic experiences in order to foster an inclusive and innovative academic environment. Therefore, investigating these issues is paramount for the successful integration of AI and ML in higher education (Olalere et al., 2020; Olayinka, 2021); especially university education being the ivory tower of knowledge. This study explored the integration of Artificial Intelligence (AI) and Machine Learning (ML) on educational outcomes in Nigerian universities, focusing on providing analysis on their effectiveness utilizations, benefits and challenges encountered while using these technologies.

### 2.2 Research Purposes:

1. To evaluate the effectiveness of AI and ML tools in personalizing learning experiences in Nigerian universities.
2. To assess the impact of AI and ML on student retention through predictive analytics.
3. To explore how AI and ML optimize resource management in higher education.
4. To identify the benefits of integrating AI and ML technologies into the educational landscape.

- To identify the challenges of integrating AI and ML technologies into Nigerian universities educational.

### 2.3 Research Questions:

- How do AI and ML tools personalize learning experiences in Nigerian universities?
- What role do predictive analytics play in improving student retention through AI and ML?
- What ways do AI and ML contribute to optimizing resource management in Nigerian university education?
- What are the perceived benefits of integrating AI and ML in the educational context of Nigerian universities?
- What are the perceived challenges of integrating AI and ML in the educational context of Nigerian universities?

## 3. Methodology

**3.1 Research Design/Sample and Sampling Techniques:** this is a descriptive research of the survey type. A total of Nine hundred and sixty-two (962) students were randomly sampled from 13 purposively sampled universities in the Southwest, Nigeria.

**3.2 Instrumentation:** self-structured questionnaire was the research instrument used to collect response on: Personalization, Retention, and Resource Optimization of Education with Artificial Intelligence and Machine Learning. A total of 962 out of 1430 copies of the research instruments were retrieved from the respondents. Items on the study were structured to elicit responses from the respondents based on Likert rating scale of Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SA). Strongly Agreed (SA), and Agreed (A) were collapsed as Agreed; while Disagreed (D) and Strongly Disagreed (SA) were also collapsed as Disagreed. The reliability indices  $r=0.92, 0.76, 0.85, 0.87$  and  $0.89$  of the research instrument was attained using Cronbach Alpha on how AI and ML tools are used to personalize learning experiences, predictive analytics roles in improving student retention through AI and ML, contributions of AI and ML to optimizing resource management in university education, perceived benefits of integrating AI and ML and perceived challenges of integrating AI and ML in the educational context of Nigerian universities respectively at 0.05 level of significance. The data generated were analyzed using descriptive and inferential statistics. Research questions 1-5 were analyzed using frequency counts, means and percentages and Standard Deviations.

## 4. Results and discussion

### 4.1 Demographic Information of the Samples

Table 1: Respondents based on Gender

Gender	Frequency	Percent (%)	Valid Percent	Cum. Freq.	Mean
Male	604	62.8	62.8	37.2	3.46
Female	358	37.2	37.2	<b>100.0</b>	3.18
<b>Total</b>	<b>962</b>	<b>100.0</b>	<b>100.0</b>		

Table 1 showed that 604 (62.8%) male and 358 (37.2%) female students participated in the study. The high mean score of male (3.46) and female (3.18) students out of 4.00 signifies high impact of Artificial Intelligence and Machine Learning. However, the high means scores (3.46) of male students exemplified their high impact on effectiveness of AI and ML for pedagogic experiences than their female (3.18) counterparts.

Table 2: Respondents based on institution Ownership

Ownership	Frequency	Percent (%)	Valid Percent	Cum. Freq.	Mean
Federal	586	60.9	60.9	39.1	3.37
State	376	39.1	39.1	<b>100.0</b>	3.34
<b>Total</b>	<b>962</b>	<b>100.0</b>	<b>100.0</b>		

Table 2 showed that 586 (60.9%) federal and 376 (39.1%) state tertiary institution students participated in the study. The mean score of students from federal and state government owned universities on the impact of Artificial Intelligence and Machine Learning on university education in Southwest, Nigeria, were 3.37 and 3.34, respectively out of 4.00. Considering the benchmark of 2.5, the high mean score (above 3.00) showed that Artificial Intelligence and Machine Learning has impact on university education of students from both federal and state government owned universities. However, the high means scores (3.37) of students from federal government owned universities exemplified their high impact on effectiveness of AI and ML for pedagogic experiences than their counterparts from state (3.34) owned universities.

**Research Questions1:** How do AI and ML tools personalize learning experiences in Nigerian universities?

**Table 3:** Students' Responses on How AI and ML tools Facilitate in Personalizing Learning Experiences in Nigerian universities

S/No	Items	ΣfA	%	ΣfD	%	X	SD
1	AI-driven platforms :						
	• assist in tailoring educational content to individual	789	82.0	173	18.0	3.1	0.82
	• students' learning speeds and styles.	892	92.7	70	7.3	3.5	0.93
	• Improve learning engagement and retention.	678	70.5	284	29.5	2.7	0.71
	• adapt in real-time based on performance data.	776	80.7	186	19.3	3.1	0.81
	• help students to master concepts at their own pace.	891	92.6	71	7.6	3.5	0.93
	<b>Gran mean score</b>	<b>805</b>	<b>83.7</b>	<b>157</b>	<b>16.7</b>	<b>3.2</b>	<b>0.84</b>
2	Machine learning algorithms:						
	• provide immediate feedback.	879	91.4	83	8.6	3.4	0.91
	• customized feedback on assignments and assessments.	686	71.6	276	28.4	2.7	0.71
	• allowing students to understand their strengths and areas for improvement more effectively.	679	70.6	283	29.4	2.6	0.71
	• ML is crucial for enhancing learning outcomes.	708	73.6	254	26.4	2.8	0.74
	<b>Grand mean score</b>	<b>738</b>	<b>76.7</b>	<b>224</b>	<b>23.3</b>	<b>2.9</b>	<b>0.77</b>
3	• AI tools are used to analyze students' progress and preferences to suggest relevant resources (articles, videos, or practice exercises).	903	93.9	59	6.1	3.6	0.94
	• AI tools ensure that students receive materials that best support their learning paths.	792	82.3	170	17.7	3.1	0.82
	<b>Grand mean score</b>	<b>847</b>	<b>88.1</b>	<b>115</b>	<b>11.9</b>	<b>3.4</b>	<b>0.88</b>
4	AI and ML enhances:						
	• personalized learning experiences in order foster higher engagement by aligning educational content with students' interests and prior knowledge.	787	81.8	175	18.2	3.1	0.82

	• application of prior knowledge that can lead to more motivating and enjoyable learning environment.	798	83.0	164	17.0	3.2	0.83
	• <b>Grand mean score</b>	<b>793</b>	<b>82.4</b>	<b>169</b>	<b>17.6</b>	<b>3.2</b>	<b>0.82</b>
5	AI and ML tools can:						
	• efficiently manage large student populations to actualize personalized learning.	931	96.8	31	3.2	3.7	0.97
	• make personalized education feasible in diverse and expansive educational settings.	923	96.0	39	4.0	3.7	0.96
	<b>Grand mean score</b>	<b>927</b>	<b>96.4</b>	<b>35</b>	<b>3.6</b>	<b>3.7</b>	<b>0.96</b>
	<b>Cluster Mean Score</b>	<b>822</b>	<b>85.5</b>	<b>140</b>	<b>14.5</b>	<b>3.2</b>	<b>0.85</b>

**Note:**  $\Sigma fA$  means sum of collapse on strongly agreed and agreed responses,  $\Sigma fD$  means sum of collapse on strongly Disagreed and Disagreed responses,  $X$  = means score and  $SD$  = Standard Deviation

Table 3 revealed students' responses on how AI and ML tools assist in personalizing learning experiences in Nigerian tertiary institutions. The frequency counts 805(83.7%) and grand mean score (3.2) depicts that AI-driven platforms assisting in tailoring educational content to individual, students' learning speeds and styles, improve learning engagement and retention, adapt in real-time based on performance data and help students to master concepts at their own pace. Also, the frequency counts 738(76.7%) and grand mean score of(2.9) depicts that machine learning algorithms provide immediate feedback, customized feedback on assignments and assessments, allowing students to understand their strengths and areas for improvement more effectively and enhance learning outcomes of students. **Subsequently**, frequency counts 793(82.4%) and grand mean score (3.2) depicts that **AI and ML enhances** personalized learning experiences by fostering higher engagement by aligning educational content with students' interests and prior knowledge and application that can lead to more motivating and enjoyable learning environment. The frequency counts {822(85.5%)} and cluster grand mean score of 3.2 exemplified responses of respondents that the deployment and integration of AI and ML tools greatly facilitate personalizing learning experiences among students.

**Research Questions 2:** What role do predictive analytics play in improving student retention through AI and ML?  
 Table 4: Predictive Analytics in Improving Student Retention through AI and ML

S/No	Items	$\Sigma fA$	%	$\Sigma fD$	%	$X$	$SD$
1	Predictive analytics can identify students at risk of dropping out by analyzing data on academic performance, attendance, and engagement.	931	96.8	31	3.2	3.7	0.97
2	Tailored interventions (tutoring, counseling, or mentorship programs) can be deployed to address student with specific needs in order to improve their chances of retention.	897	93.2	65	6.8	3.5	0.93
3	Various institutions use predictive analytics to evaluate the effectiveness of different retention strategies.	456	47.4	506	52.6	1.8	0.47
4	Predictive models are used for assessments including socio-economic background and campus engagement, to provide a comprehensive understanding of the challenges faced by students.	789	82.0	173	18.0	3.1	0.82
	<b>Cluster Mean Score</b>	<b>768</b>	<b>79.8</b>	<b>194</b>	<b>20.2</b>	<b>3.0</b>	<b>0.80</b>

**Note:**  $\Sigma fA$  means sum of collapse on strongly agreed and agreed responses,  $\Sigma fD$  means sum of collapse on strongly Disagreed and Disagreed responses,  $X$  = means score and  $SD$  = Standard Deviation

**In answering research question 2 on the roles played by** predictive analytics in improving student retention through AI and ML, Table 4 shows the frequency counts {768(79.8%)} and cluster grand mean score of 3.0

revealed that predictive analytics help in identifying students at risk of dropping out by analyzing data on such students' academic performance, attendance and engagement; in order to tailor interventions (tutoring, counseling, or mentorship programs) that are suitable to be deployed to address such student with specific needs in order to improve their chances of retention. By implication, the findings revealed that predictive analytics played a good deal of roles in improving student retention through the instrumentality of AI and ML tools.

**Research Questions 3:** What ways do AI and ML contribute to optimizing resource management in Nigerian university education?

**Table 5:** Optimizing Resource Management in University Education through Contribution of AI and ML

S/No	Items	ΣfA	%	ΣfD	%	X	SD
1	Predictive analytic facilitate:						
	• easy analysis of historical data in order to predict student enrollment trends.	768	79.8	194	20.2	3.0	0.80
	• helps institutions to optimize course offerings	897	93.2	65	6.8	3.5	0.93
	• allocation of resources effectively.	932	96.9	30	3.1	3.7	0.97
	• efficient and effective staffing, classroom space, and materials to be used.	942	98.2	20	1.8	3.7	0.98
	<b>Grand mean score</b>	<b>885</b>	<b>92.0</b>	<b>77</b>	<b>8.0</b>	<b>3.5</b>	<b>0.92</b>
2	Personalized Learning enhance:						
	• tailoring of educational content to individual needs with the use of AI and M.	792	82.3	170	17.7	3.1	0.82
	• reducing unnecessary resource usage.	896	93.1	36	6.9	3.5	0.93
	• direct students to resources that best match their learning paths.	799	83.1	163	16.9	3.2	0.83
	• minimizing the need for digesting broad and generalized materials.	921	95.7	41	4.3	3.6	0.96
	<b>Grand mean score</b>	<b>852</b>	<b>88.6</b>	<b>110</b>	<b>11.4</b>	<b>3.4</b>	<b>0.89</b>
3	Administrative Automation facilitate:						
	• streamlining administrative tasks such as scheduling, admissions, and financial aid processing.	785	81.6	177	18.4	3.1	0.82
	• reduces manual workload on staff	829	86.2	133	13.8	3.3	0.86
	• frees up resources for more strategic initiatives.	911	94.7	51	5.3	3.6	0.95
	<b>Grand mean score</b>	<b>842</b>	<b>87.5</b>	<b>120</b>	<b>12.5</b>	<b>3.3</b>	<b>0.88</b>
4	Effective use of AI and ML providesupport to student through:						
	• Chatbots and virtual assistants can provide 24/7 support to students.	943	98.0	19	2.0	3.7	0.98
	• reducing the strain on human resources while ensuring students receive timely assistance.	897	93.2	65	6.8	3.5	0.93
	<b>Grand mean score</b>	<b>920</b>	<b>95.6</b>	<b>42</b>	<b>4.4</b>	<b>3.6</b>	<b>0.96</b>
5	Resource allocation facilitate for effective use of AI and ML:						
	• enhance decision-making regarding budget allocation.	905	94.1	57	5.9	3.6	0.94

- ensuring that funds are directed towards areas with the highest impact on student success and institutional goals.

<b>Grand mean score</b>	<b>901</b>	<b>93.7</b>	<b>61</b>	<b>6.3</b>	<b>3.6</b>	<b>0.94</b>
<b>Cluster mean score</b>	<b>888</b>	<b>92.3</b>	<b>74</b>	<b>7.7</b>	<b>3.5</b>	<b>0.92</b>

**Note:**  $\Sigma fA$  means sum of collapse on strongly agreed and agreed responses,  $\Sigma fD$  means sum of collapse on strongly Disagreed and Disagreed responses,  $X$  = means score and  $SD$  = Standard Deviation

Table 5 revealed the analysed data that were collected to answer the research question on the strategies employed to contribute to optimizing resource management in Nigerian tertiary education via the use of AI and ML. The respondents attested that predictive analytics was employed with the frequency counts 885(92.0%) and grand mean score of and 3.5. Predictive analytic facilitate easy analysis of historical data in order to predict student enrollment trends, helps institutions to optimize course offerings, allocation of resources and facilitate efficient and effective staffing, classroom spacing, and the need materials to be used by the institution. Subsequently, personalized learning {frequency counts 852(88.6%) and mean score 3.4} strategy was employed via the use of AI and ML to enhance tailoring of educational content to individual needs, direct students to resources that best matches their learning paths, minimizing the need for digesting broad and generalized materials; thereby reducing unnecessary resources usage. Also, the respondents were of the opinion with the frequency counts of 842(87.5%) and mean score 3.3 that administrative automation was employed to streamline administrative tasks such as scheduling, admissions, and financial aid processing in their respective institutions to reduce reduces manual workload on staff; thereby freeing up resources for more strategic initiatives in the nearest future. This was done to ensure funds are directed towards areas with the highest impact on student success and institutional goals {897(93.2%) and mean = 3.5}. Conclusively, the total frequency counts 888(92.3%) with the cluster mean score revealed that the strategies of using AI and ML contribute in no small measure in optimizing resource management. Table 6 showed the perceived benefits derived through integrating AI and ML into Nigerian educational system.

**Research Questions 4:** What are the perceived benefits of integrating AI and ML in the educational context of Nigerian universities?

Table 6: Perceived Benefits of Integrating AI and ML into Nigerian Tertiary Educational System

S/No	Items	$\Sigma fA$	%	$\Sigma fD$	%	X	SD
1	AI facilitates tailoring of educational experiences in order to enhance student engagement.	790	82.1	170	17.9	3.1	0.82
2	AI enables adapting content to individual learning styles and paces in order to enhance student academic performance.	823	85.6	139	14.4	3.3	0.86
3	ML helps in efficient allocating of resources based on predictive analytics, thereby improving overall management and reducing costs.	941	97.8	21	2.2	3.7	0.98
4	Automation of administrative tasks through AI reduces manual workload and facilitates staff to focus on more strategic activities.	812	84.4	150	15.6	3.2	0.84
5	AI tools help in identifying students at risk of academic challenges, and provide support services to improve student retention rates.	754	78.4	208	21.6	3.0	0.78

6	AI and ML tools allowing students to undertake complex studies that can lead to more innovative outcomes via data analysis and research.	926	96.3	36	3.7	3.7	0.96
7	AI helps to take informed decisions based on data analysis that will birth improved academic and administrative strategies.	798	83.0	164	17.0	3.2	0.83
8	AI tools can assist students with disabilities by providing adaptive technologies that will make learning more inclusive.	918	95.4	44	4.6	3.6	0.95
9	AI-driven platforms offer personalized career advice and job matching that will improve student employability.	892	92.7	70	7.3	3.5	0.93
10	ML assists in language learning and translation services in order to overcome language barriers in academic materials.	863	89.7	99	10.3	3.4	0.90
11	AI enhances online learning environments through interactive and engaging contents that support remote education initiative.	923	96.0	39	4.0	3.7	0.96
<b>Cluster Mean Score</b>		<b>858</b>	<b>89.2</b>	<b>104</b>	<b>10.2</b>	<b>3.4</b>	<b>0.89</b>

**Note:**  $\Sigma fA$  means sum of collapse on strongly agreed and agreed responses,  $\Sigma fD$  means sum of collapse on strongly Disagreed and Disagreed responses,  $X$  = means score and  $SD$  = Standard Deviation

Table 6 revealed the analysed data that were collected to answer the research question on the perceived benefits of integrating AI and ML into Nigerian tertiary educational system. The respondents attested that there are batteries of benefits accruing to integration of AI and ML as: AI facilitates tailoring of educational experiences in order to enhance student engagement {790(82.1%) with means=3.1}; AI enables adapting content to individual learning styles and paces in order to enhance student academic performance {823(85.6%)with means=3.3}; ML helps in efficient allocating of resources based on predictive analytics, thereby improving overall management and reducing costs {941(97.8%) with means=3.7}; Automation of administrative tasks through AI reduces manual workload {812(84.4%); identifying students at risk of academic challenges, and provide support services to improve student retention rates {754(78.4%)with means=3.0}; allow students to undertake complex studies that can lead to more innovative outcomes via data analysis and research {926(96.3%) with means=3.7}; assist students with disabilities by providing adaptive technologies that will make learning more inclusive {918(95.4%) with mean = 3.6}; offer personalized career advice and job matching that will improve student employability {892(92.7% with mean = 3.5 ); and enhances online learning environments through interactive and engaging contents that support remote education initiative {923(96.0% with mean = 3.7 ). The total frequency counts 858(98.2%) and cluster mean score of 3.4 exemplified that the benefits derived from integrating AI and ML into university education are enormous in influencing pedagogic experiences. Table 7 shows that despite the related benefits derived in integrating AI and ML to pedagogic experiences in Nigerian university systems; Research Questions 5 answered the existence of perceived challenges of integrating AI and ML in Nigerian tertiary educational context.

**Research Questions 5:** What are the perceived challenges of integrating AI and ML in the educational context of Nigerian tertiary institutions?

**Table 7:** Perceived Challenges of Integrating AI and ML in the Educational Context of Nigerian Students

S/No	Items	$\Sigma fA$	%	$\Sigma fD$	%	X	SD
1	There Insufficient technological infrastructure (high-speed internet and modern hardware) to support AI and ML implementation.	567	58.9	395	41.1	2.2	0.59

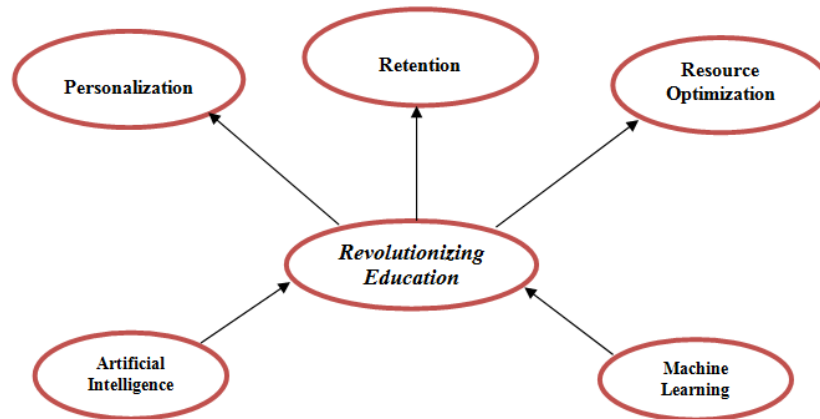
2	High financial investment is posing substantial barrier for many universities to procure the required AI and ML technologies such as software, hardware, and maintenance.	796	82.7	166	17.3	3.1	0.83
3	Breaches are encountered in ensuring the security and privacy of student data used in AI systems often leads to serious privacy issues.	658	68.4	304	31.6	2.6	0.68
4	There are shortages of staff with the required expertise to implement and maintain AI and ML systems effectively.	892	92.7	70	7.3	3.5	0.93
5	Adoption of new technologies often meets resistance from stakeholders who are accustomed to traditional teaching methods.	919	95.5	43	4.5	3.6	0.96
6	Bias in algorithms and potential for AI to make decisions that impact students' academic future exist with reference to ethical related questions.	674	70.1	288	29.9	2.7	0.70
7	Disparities in access to technology among students can lead to unequal learning opportunities via AI and ML.	871	90.5	91	9.5	3.4	0.91
8	Limited resources affect continuous technical support and maintenance that are necessary for AI systems.	917	95.3	45	4.7	3.6	0.95
9	Compliance with local laws and regulations regarding technology use and data protection can be complex and burdensome.	649	67.5	313	32.5	2.6	0.67
10	Financial related implications are affecting long term sustainability of AI and ML initiatives in most universities.	896	93.1	66	6.9	3.5	0.93
11	Technological related implications are affecting long term sustainability of AI and ML initiatives in most universities.	898	93.4	64	6.6	3.6	0.93
	Cluster Mean Score	<b>794</b>	<b>82.5</b>	<b>168</b>	<b>17.5</b>	<b>3.1</b>	<b>0.83</b>

**Note:**  $\Sigma fA$  means sum of collapse on strongly agreed and agreed responses,  $\Sigma fB$  means sum of collapse on strongly Disagreed and Disagreed responses,  $X$  = means score and  $SD$  = Standard Deviation

Table 7 revealed the analysed data that were collected to answer the research question on perceived challenges encountered by university students in integrating AI and ML for pedagogic experiences. The respondents attested that there are perennial challenges accruing to integration of AI and ML as High financial investment is posing substantial barrier for many universities to procure the required AI and ML technologies such as software, hardware, and maintenance {796(82.7%) with means=3.1}; shortages of staff with the required expertise to implement and maintain AI and ML systems{892(92.7%) with means=3.5}; adoption of new technologies often meets resistance from stakeholders who are accustomed to traditional teaching methods{919(95.5%) with means=3.6}; financial related implications are affecting long term sustainability of AI and ML initiatives in most universities{896(93.1%) with means=3.5}; and technological related implications are affecting long term sustainability of AI and ML initiatives in most universities{898(93.4%) with means=3.6}. The total frequency counts 794(82.5%) and cluster mean score of 3.1 exemplified that perennial challenges are encountered in integrating AI and ML into university education are enormous to influence pedagogic experiences. This study investigated the impact of Artificial Intelligence and Machine Learning on personalization, retention, and resource optimization in Nigerian tertiary education. Vis-à-vis research question one on effectiveness of AI and ML tools in personalizing learning experiences; this study agreed with Odufuwa, and Salami (2021) that attested to widespread adoption of AI and ML in Nigerian higher education to be gaining momentum due to growing awareness (Adeoye & Alao, 2022) of the potential benefits of AI and ML in educational settings; government and educational institutions support (Eze & Chinedu-Eze, 2020) given recently and increasing research and innovation (Oladejo & Olatunji, 2021) within Nigerian universities (Ibrahim & Musa, 2023) focusing on AI and ML integration into Nigerian education curricula and teaching methods. Also, research question two agreed with Olaleye and Oyewole, (2020) that these technologies offer personalized learning experiences, enhance student retention through predictive analytics, and optimize

resource management, contributing to more efficient administrative operations. The application of AI and ML in research and innovation accelerates academic progress by enabling advanced data analysis and pattern recognition (Nwachukwu, 2019). The author further buttressed that integration of Artificial Intelligence (AI) and Machine Learning (ML) offers promising solutions to personalized learning experiences, tailoring content to individual student needs, thereby enhancing engagement and understanding (Eze et al., 2021). This personalized approach not only boosts understanding but also supports students from diverse linguistic backgrounds, an essential consideration in Nigeria's multilingual context (Adeyemi, 2021). Predictive analytics powered by AI and ML can identify students at risk of underperformance, enabling timely interventions that improve retention rates (Ikechukwu & Nwankwo, 2019); thereby supporting findings that answered research questions three. This proactive approach is crucial for enhancing student success and overall institutional effectiveness. According to Ogunde and Adeyemi (2022), AI and ML technologies optimize resource management, streamlining administrative operations and ensure efficient allocation of limited resources; that is the unique benefits derived from their integration into university educational system. Despite the numerous benefits derived from their integration, this study agreed with (Oluwadare, 2019; Afolabi & Okebukola, 2020; Olabode (2021). Myriads of literature reviewed substantiates the existence of some the challenges faced in many Nigerian higher institutions of learning as infrastructure limitations, lacking high-speed internet, computing resources, and updated software essential for AI and ML implementation (Adeyemo, 2020); shortage of qualified personnel to deploy and integrate AI and ML technologies (Olabode, 2021); and Limited financial resources allocated to AI and ML research and development. The author further attested data privacy in the AI use is crucial for the ethical implementation of AI and ML in educational setting. Figure 4.2 depicts Artificial Intelligence (AI) and Machine Learning (ML) being instrumental in revolutionizing education by enabling unprecedented levels of personalization, enhancing student retention, and optimizing resource allocation.

**4.2: The interrelationship in the context of Revolutionizing Education with Artificial Intelligence and Machine Learning: Personalization, Retention, and Resource Optimization.**



**Figure1:** Revolutionizing Education with Artificial Intelligence and Machine Learning: Personalization, Retention, and Resource Optimization

**Source:** Adenubi and Samuel (2024)

Figure 1 depicts that Artificial Intelligence (AI) and Machine Learning (ML) are revolutionizing education by enabling unprecedented levels of personalization, enhancing student retention, and optimizing resource allocation. This diagram illustrates how AI and ML intersect with educational innovation, driving significant advancements in tailoring learning experiences, keeping students engaged, and efficiently utilizing educational resources

Key Components:

1. Artificial Intelligence and Machine Learning: These are the foundational technologies driving the revolution in education.
2. Revolutionizing Education: The central concept that AI and ML contribute to, focusing on transforming educational practices.
3. Personalization, Retention, and Resource Optimization: The three key areas impacted by the revolution in education through AI and ML.

#### Relationships:

- Artificial Intelligence and Machine Learning both contribute directly to Revolutionizing Education.
- The revolution in education facilitated by AI and ML leads to improvements in Personalization (tailoring education to individual students), Retention (keeping students engaged and reducing dropout rates), and Resource Optimization (efficient use of educational resources). This model visually demonstrates how AI and ML technologies are central to transforming education, with direct effects on personalization, retention, and resource optimization. This interconnected framework underscores the pivotal role of AI and ML in addressing contemporary educational challenges and enhancing the overall learning experience

## 5. Conclusion

This study explored the impact of AI and ML Personalization, Retention, and Resource Optimization of Education with Artificial Intelligence and Machine Learning. It found that the adoption of AI and ML tools enhance personalized learning experiences, improve student retention through predictive analytics, and optimize resource management, making educational operations more efficient. However, challenges such as infrastructure limitations, shortage of qualified personnel, and limited financial resources hinder their full integration. To maximize benefits of AI and ML to the fullest, it is recommended that Nigerian universities administrators, government and non-governmental organizations should partner with Nigerian universities in order procure and invest in infrastructure, training and funding to support AI and ML initiatives.

The following suggestions are recommended based on the findings from this study:

1. The deployment and integration of AI and ML tools into Nigerian institutions of higher learning will greatly facilitate personalizing learning among the students.
2. The use of predictive analytics through the instrumentality of AI and ML tools should be encouraged since it showed good deal of roles played in improving student retention.
3. The strategy of using AI and ML in optimizing resource management in Nigerian institutions of higher learning will discourage unnecessary waste of human and materials resources.
4. The benefits of integrating AI and ML into Nigerian institutions of higher learning are enormous in influencing pedagogic experiences; hence their integration should be encouraged in all ramifications.
5. Procurement of adequate AI and ML related facilities should be made by administrators, government and non-governmental organizations for Nigerian higher institutions of learning. Also, organization of seminars and intensive training on how to judiciously integrate AI and ML into every aspect of pedagogic experiences should be encouraged by the students, teaching and administrative staff.

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