

AI-Driven Personalized Learning Tools as Catalysts of Digital Transformation in TVET education: Exploring Digital Natives' Experiences

¹Asogwa Emmanuel C., ¹Akubuko Phoebe A., ²Eze Benedict C. & ¹Ogbuabor Priscilla N.

¹Department of Computer and Robotics Education, University of Nigeria, Nsukka

²Department of Arts Education, University of Nigeria, Nsukka

chinonye.asogwa@unn.edu.ng

Abstract

Artificial Intelligence (AI) is reshaping the educational landscape by enabling tools that personalize learning experiences to meet individual learner needs. Despite its global advancement, the integration of AI-powered personalized learning tools among digital natives in learning, particularly within the TVET institution in developing regions among digital native's remains underexplored. This study therefore, investigates digital natives' experiences with AI-driven personalized learning tools and their influence on digital transformation. A descriptive survey design was adopted, and data were collected using a structured questionnaire administered via Google Forms. The instrument was validated by experts and recorded a reliability coefficient of 0.81 using Cronbach's alpha. Data were analyzed using mean and standard deviation with a cut-off mean of 2.5, while factor loading was used to assess how well each item measured its intended construct. Findings indicate that AI-based personalized learning promotes engagement in learning, improves interaction, and motivation among digital natives by offering adaptive content and instant feedback. However, the study highlights digital literacy gap, high implementation costs, limited institutional funding, and reluctance among educators to integrate AI tools in teaching as the key challenges hindering its effective adoption. It therefore recommended that educators should encourage the responsible use of AI-powered tools. Both staff and students should also receive regular digital literacy training to foster inclusive and technology-driven learning environments.

Keywords: AI-Driven Learning; Digital Natives; Adaptive Learning Systems; Networking Education; Digital Inclusion. TVET

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in the 21st century, fundamentally reshaping the educational landscape and the ways learners engage with knowledge. It offers innovative solutions that improve teaching and learning processes through adaptive, data-driven, and learner-centered approaches (Chassignol et al., 2018). By integrating large datasets, algorithms, and computational intelligence, AI can solve complex educational problems relating to practical oriented courses like computer networking and personalize learning experiences (Gasser & Almeida, 2017). AI plays a central role in intelligent tutoring systems, adaptive learning platforms, and automated assessment tools

that tailor instruction to learners' individual needs. These systems dynamically adjust learning paths, generate images for networking courses, identifies areas for improvement, provide real-time feedback, and promotes self-directed learning and academic performance (Lin et al., 2023). Networking courses are designed to equip learners with the competencies and skills required to design, implement, and manage computer networks environment effectively (Forouzan, 2017). These courses typically cover fundamental topics such as network foundations, IP addressing, subnetting, routing and switching, network security and wireless technologies, as well as Software-defined networking (SDN) and cloud computing (Forouzan, 2017; Kurose & Ross, 2021). As practical-oriented course in TVET

that can be learned even with limited instructional support, AI-powered personalized learning facilitates the creation of high-quality instructional materials which may not physically available to enhance learning and formative assessments (Cacicio & Riggs, 2023). It often incorporates simulations, virtual labs, and hands-on assessments to deepen digital natives' understanding of networking concept and prepare them for real-world networking challenges (Panko & Panko, 2021). For instance, when learning how to configure IP addresses, AI-powered tools like ChatGPT can guide learners through each step of the process when properly prompted. Therefore, the integration of AI-driven personalized learning tools in TVET education represents a key step toward digital transformation in higher education, fostering innovation in pedagogy, assessment, and digital native's engagement in lesson. TVET is a subdivision of education that comprises continuing professional development and work-based learning (UNESCO, 2016). It provides digital natives students with the 21st-century digital skills like critical thinking, problem-solving, as well as Artificial Intelligence (AI) knowledge (Razali, et al, 2023).

Digital native are category of students who were born after the widespread adoption of digital technology, inherently an active user of technology and technology-savvy. Students born after 1981 are also referred to as digital native (Prensky 2001). So, majority of the current students studying computer networking courses can be referred to as digital natives. This group of students are expected to have high access to the Internet and use it extensively for learning, work and leisure. However, the adoption of AI-powered personalized learning in tertiary education still raises concerns related to equity, access, and readiness to adopt in learning. Learners from rural or low-income area like Nigeria often face barriers such as financial constraints in

procurement of the AI tools, lack of digital devices, and limited exposure or access to AI-based personalized tools (Ubiminds, 2024; Selwyn, 2019). These disparities risk widening the existing digital divide and may hinder the realization of AI's transformative potential in higher education, especially in developing regions (Ogunode et al., 2023). It unfortunate to see educators expressing skepticism about the reliability of AI technologies or fear that such systems could replace traditional teaching roles (Clark et al., 2019). This therefore, results in low adoption of the tool for teaching and learning

Against this backdrop, this study aims to examine digital native's perceptions of the impact of AI-driven personalized learning tools as a catalyst for digital transformation in TVET education. Specifically, the study tends to identify the perceptions of digital native learners on the adoption of AI-driven personalized learning, perceived impact of AI-driven personalized learning tools on digital native' academic achievement and engagement and identify the possible challenges that hinder the effective adoption and utilization of AI-driven personalized learning tools in learning networking courses.

Research Questions

To achieve the stated objectives, the following research questions were raised to guide the study:

1. What are the perceptions of TVE students on the adoption of AI-driven personalized learning tools for learning
2. How do AI-driven personalized learning tools influence TVET students' academic achievement
3. What are the challenges that hinder the effective adoption of AI-driven personalized learning tools in TVET institution institutions?

Research Hypotheses

The following null hypotheses will be tested at a 0.05 level of significance:

- **H₀₁:** There is no significant difference in the mean responses of male and female students regarding their perceptions of the adoption of AI-driven personalized learning tools.
- **H₀₂:** There is no significant difference in the mean responses of male and female students regarding the perceived influence of AI-driven personalized learning tools on academic achievement.
- **H₀₃:** There is no significant difference in the mean responses of male and female students regarding the challenges that hinder the effective adoption of AI-driven personalized learning tools in tertiary institutions.

Literature review

AI Powered Personalized online Learning among Digital Natives

The integration of Artificial Intelligence into higher education is gradually changing pedagogical approaches, particularly in the aspect of electronic learning by allowing unprecedented levels of personalization (Maghsudi et al., 2021). AI powered personalized learning helps to adapt educational content and interactions to suit with individual learners' unique needs, preferences, and pace (Jian, 2023). This adaptive approach goes beyond traditional, standardized instructional methods, thereby offering dynamic learning pathways that address the real-time student performance and engagement (Jian, 2023; Naseer et al., 2024). It also nurtures more effective and meaningful educational experiences by allowing adaptive learning environments that adjust content, pacing, and instructional methods to each student's unique characteristics (Merino-Campos, 2025). Some examples of AI powered personalised learning environments include intelligent tutoring systems such as Khanmigo, Mindjoy, Edcafe AI; adaptive learning

platforms such as 30Learning, Adaptemy Knewton and SafetyCulture, and AI-driven feedback adaptive learning that dynamically adjust to student progress and comprehension (Al-Zahrani & Alasmari, 2024; George & Wooden, 2023). These tools can act as personal tutors, offering instant feedback, answering queries, and even suggesting supplementary resources based on the student's learning trajectory (Winkler & Söllner, 2018). Such AI-driven interventions are particularly relevant for student engagements in the context of remote learning, where students might feel isolated due to the lack of face-to-face interactions. Though, it becomes essential to understand the characteristics of the learners themselves, particularly those often described as “digital natives”, a generation inherently immersed in technology from an early age, shaping their expectations, learning preferences, and interaction with digital tools (Prensky, 2001; Christodoulou et al., 2018).

The term “digital native” was introduced in 2001 by Marc Prensky that anyone born after 1980 *are referred to Digital Natives* (Prensky, 2001). Although, time stipulations between researchers for generations (Christodoulou E., Kalokairinou et. Al., 2018) as *Generation Y* are born between 1981 and 1995 (Australian Bureau of Statistics (ABS) 2021), *The Net Generation* are born between 1980 and 2001 (Sherman 2009); *Google Generations* are born after 1993 (Rowlands et. al.,) and the current generation, *Generation Z*, are born between 1996 and 2010.

Barriers to Effective Implementation of AI personalized learning in TVET education

The implementation of personalized learning is not without challenges. Technological limitations often restrict access to necessary resources for both students and educators, leading to disparities in educational opportunities (Niknam &

Thulasiraman, 2020). Resistance from educators who may be unfamiliar with or skeptical about new technologies can as well, hinder AI powered personalized online learning adoption (Sharples, 2000). Ethical concerns related to data privacy also pose significant challenges; as personalized learning relies heavily on data collection and analysis, ensuring the security of sensitive information is paramount (Lockspeiser & Kaul, 2016). Socio-economic factors also play a crucial role in determining students' ability to access the necessary technology for AI-driven learning. Students from lower socio-economic backgrounds often lack access to devices such as laptops or tablets, as well as reliable internet connections (Selwyn, 2019). This lack of access not only limits their ability to engage with AI tools but also exacerbates existing educational inequalities.

Data privacy concerns represent another significant barrier to the effective implementation of AI in education. Educational institutions must navigate complex legal frameworks governing data privacy while striving to comply with regulations such as the Family Educational Rights and Privacy Act (FERPA) in the United States or the General Data Protection Regulation (GDPR) in Europe (Zawacki-Richter et al., 2019). These regulatory compliance challenges can create obstacles for schools attempting to adopt AI technologies, as they must ensure that student data is collected, stored, and used ethically and securely. Attitudes toward AI usage in teaching practices can significantly influence how readily educators embrace these technologies. Some teachers may harbor skepticism about the effectiveness of AI tools or fear that they will replace traditional teaching methods (Clark et al., 2019). Addressing these barriers is essential for maximizing its potential benefits.

Methodology

A descriptive survey research design was adopted for this study with a population of 2679 gotten from six public universities in South East Nigeria (University of Nigeria, Nsukka, Nnamdi Azikiwe University, Ebonyi State University, Enugu State University of Science and Technology, Micheal Okpara University of Agriculture, and Chukwuemeka Odimegwu Ojukwu University), focusing on computer and Robotics/computer education department from the institution. Data on the population were obtained from the records available at the respective departments in each university at the time of this research, 2024/2025 session. A sample size of 350 (200 male and 150 female) was employed for this study. Their respective age were taken into consideration to ensure that the study involved only the digital native students. This was obtained using a multi-stage sampling technique. Data collection was facilitated through the utilization of a structured questionnaire that were structured into two distinct sections: Section A focuses on acquiring demographic information from each respondent, while Section B is intricately organized into three clusters containing 30 items, with each cluster dedicated to addressing specific research questions. A 4-point rating scale was utilized for 1, 2, and 3, with the following designations: Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. The instrument was also face validated by three experts from the Department of Computer and Robotics Education, and computer science, University of Nigeria Nsukka. Cronbach Alpha test was applied for ascertaining the reliability of the research instrument. Furthermore, the factor loadings of each item construct range from 0.564 0.940 for cluster one; 0.740 to 0.850 for cluster two and 0.650 to 0.980 for cluster three. This indicates a closer connection and relationship between the constructs (see Table 1, 2 and 3). The researcher administered the questionnaire via Google

form in institutional Whatsapp group with the assistant of class representatives and lecturers. Collected data were analyzed using mean, standard deviation, and

independent t-test with the aid of Statistical Package for Social Sciences (SPSS) version 25.

Results

Table 1: Mean and SD of Perceptions of TVET students on the adoption of AI-driven personalized learning tools

S/N	Variables	$\bar{X}$	SD
AIA1	AI-driven tools make online learning more interactive and engaging	3.15	0.81
AIA2	AI-Powered personalised learning platforms motivate students to complete tasks and assignments,	3.26	0.82
AIA3	Personalized learning through AI helps me stay focused on my studies.	3.16	0.85
AIA4	AI personalised tools make learning more enjoyable and less boring.	3.21	0.77
AIA5	The feedback from AI personalised tools is quick and helps maintain my interest in the course.	2.91	0.92
AIA6	AI tools allow me to set learning goals, which enhances my performance.	3.09	0.94
AIA7	AI-driven learning platforms offer content tailored to my learning style and speed thereby helping in my academic achievements	3.15	0.91
AIA8	AI personalised help me actively participate in online discussions and collaborative activities.	3.07	0.83

Key: AIA = AI Adoption, SD = Standard Deviation, $\bar{X}$ = Mean

The result in Table 1 indicate that students generally agree that AI tools enhance their learning experience. The highest mean score ($\bar{X} = 3.26$) was recorded for the statement that AI-personalized platforms motivate students to complete tasks and assignments, suggesting that personalized AI-driven tools provide encouragement and structure. Similarly, AI-driven tools making learning more interactive and engaging ($\bar{X} = 3.15$), helping students stay focused ($\bar{X} = 3.16$), and making learning more enjoyable and less boring (3.21) also received high ratings, reinforcing the idea that AI contributes positively to student engagement. The

lowest mean score ($\bar{X} = 2.91$) was observed for AI feedback maintaining student interest, though it still falls within the "Agreed" category, indicating that while AI feedback is beneficial, it may not be as impactful as other engagement factors. The standard deviation values (SD = 0.77 0.94), indicate moderate variation among responses, implying consistent perceptions among participants. The overall agreement in responses suggests that AI-driven tools are effectively fostering a more interactive and engaging online learning experience for students in Computer and Robotics Education.

Table 2: Mean and Standard Deviation of perceived impacts of Ai driven personalized learning tools on TVET students' academic achievement in networking courses

S/N	Variables	$\bar{X}$	SD
PIAI1.	AI-powered personalized learning have improved my overall academic performance in online courses.	3.27	0.91
PIAI 2	AI-powered personalized learning has helped me grasp difficult concepts in my course of study	3.12	0.89
PIAI3	AI-powered personalized learning ability to provide feedback helps me identify areas where I need to improve academically.	3.15	0.90
PIAI4	This tool has helped me improve my problem-solving and critical thinking skills.	3.17	0.89
PIAI5	AI-powered personalized learning assessments provide accurate evaluations of my knowledge and skills.	3.05	0.78
PIAI6	It helps me to stay on track with my learning objectives, contributing positively to my academic success.	3.18	0.83
PIAI7	The recommendations usually made by AI-powered personalized learning tools are helpful in improving my understanding of the course material.	3.20	0.87
PIAI8	AI-driven learning platforms have positively impacted my exam preparation and performance.	3.06	0.90

Key: *PIAI = Perceived Influence of AI ; SD = Standard Deviation*

As shown in Table 2, Educators generally perceived AI-powered personalized learning tools as having a positive impact on their academic achievement. The highest-rated item ($\bar{X} = 3.27$) indicates that students perceive AI-driven tools as improving their overall academic performance in online courses. Additionally, AI tools were found to enhance problem-solving and critical thinking skills ($\bar{X} = 3.17$) and provide useful recommendations that improve students' understanding of course material ($\bar{X} = 3.20$).

These findings highlight the effectiveness of AI in creating a structured and adaptive learning environment that supports academic growth. The standard deviation values ($SD = 0.78$ to 0.91), suggest a moderate level of agreement among respondents, indicating some variability in individual experiences. These findings emphasize the effectiveness of AI in promoting personalized, adaptive, and feedback-oriented learning experiences that contribute to academic success among adult.

Table 3: Mean and Standard Deviation of the challenges that hinder the effective adoption of AI-driven personalized learning tools in TVET institutions?

S/N	Variables	$\bar{X}$	SD
CHAIA1	The high cost of AI-driven learning platforms makes them inaccessible for many students.	2.65	1.06
CHAIA2	Restriction of access to AI powered personalized learning platform	2.62	1.00

CHAIA3	Resistance from educators/lecturers	2.52	0.99
CHAIA4	Ethical concern relating to data privacy	2.62	0.92
CHAIA5	Lack of financial support for AI research and development impedes its implementation in online learning.	2.61	0.97
CHAIA6	Attitude of the institution towards adoption of this technology	3.00	1.03
CHAIA7	Digital literacy gap influences effective adoption of AI powered personalised learning tools	2.6.	1.00

Cluster Mean

0.38

Key: x = mean, CHAI A: Challenges that Hinders AI Adoption SD = Standard Deviation

The findings in Table 3 reveal several significant barriers affecting the adoption of AI-powered personalized learning. The most prominent challenge identified was the **institutional attitude toward adopting AI technology** ($\bar{X} = 3.00$), followed by the **high cost of AI-driven learning platforms** ($\bar{X} = 2.65$) and **digital literacy gaps** ($\bar{X} = 2.60$). Other notable challenges include **educator resistance** ($\bar{X} = 2.52$) and **restrictions on access to AI tools** ($\bar{X} = 2.62$). Ethical

concerns related to data privacy ($\bar{X} = 2.62$) and insufficient financial support for AI research and development ($\bar{X} = 2.61$) were also highlighted. The relatively high standard deviation values (SD = 0.92 1.06) suggest that the responses are closely related. These findings underscore the importance of addressing institutional, financial, and human capacity barriers to enable sustainable AI adoption in education contexts

Hypothesis Testing

Table 4: Independent-Samples t -Test of Gender Differences in Students' Perceptions of AI-Powered Personalized Learning Tools

Respondents	N	$\bar{X}$	SD	df	t	sig value	Decision
Male	200	3.87	1.18	348	1.17	0.12	NS
Female	150	3.7	1.06				

Key: SD=Standard Deviation; df = Degree of Freedom; $\bar{X}$ = Mean; NS = Not significant

Results from the independent-samples t -test presented in **Table 4** indicate that there was no significant difference between male students ($M = 3.87$, $SD = 1.18$) and female students ($M = 3.70$, $SD = 1.06$) in their

perceptions of AI-powered personalized learning tools, $t(211) = 1.17$, $p = .12$. Since the p -value was greater than the .05 significance level, the null hypothesis was **not rejected**.

Table 5: Independent-Samples t -Test of Gender Differences in Students' Perceptions of the Influence of AI-Driven Personalized Learning Tools on Academic Achievement

Respondents	N	$\bar{X}$	SD	df	t	Sig p).	Decision
Male	200	3.67	1.26	348	0.35	0.15	NS
Female	150	3.60	1.17				

Key: SD=Standard Deviation; df = Degree of Freedom; $\bar{X}$ = Mean; NS = Not significant

As shown in **Table 5**, there was no significant difference between male students ($M = 3.67$, $SD = 1.26$) and female students ($M = 3.60$, $SD = 1.17$) in their perceptions of the influence of AI-driven personalized learning tools on academic achievement,

$t(348) = 0.35$, $p = .15$. Since the p -value was greater than the .05 significance level, the null hypothesis (H_{02}) was **not rejected**.

Table 6: Independent-Samples t -Test of Gender Differences in Students' Perceptions of Challenges Hindering the Effective Adoption of AI-Driven Personalized Learning Tools

Respondents	N	$\bar{X}$	SD	df	t	Sig (p).	Decision
Male	100	3.67	1.26	348	0.35	0.11	NS
Female	150	3.60	1.17				

Key: SD =Standard Deviation; df = Degree of Freedom; $\bar{X}$ = Mean; NS = Not significant

Similarly, results in **Table 6** indicate no significant difference between male students ($M = 3.67$, $SD = 1.26$) and female students ($M = 3.60$, $SD = 1.17$) regarding the challenges hindering the effective adoption of AI-driven personalized learning tools, $t(211) = 0.35$, $p = .11$. Since the p -value was greater than the .05 significance level, the null hypothesis (H_{03}) was **not rejected**.

Discussion

The findings based on Research Question One indicated that AI-driven personalized learning tools make learning more interactive and engaging, motivate students to complete tasks and assignments, and help them remain focused during their studies. The findings also showed that personalized learning through AI makes learning more enjoyable and less monotonous, while the prompt feedback provided by AI tools helps sustain students' interest in learning networking courses. These findings may be attributed to the ability of AI-driven personalized learning tools to provide immediate and individualized learning support based on students' learning needs and progress. Unlike conventional learning approaches in which students may have to wait for teacher feedback, AI tools can provide timely responses, explanations, examples, and guidance, thereby reducing delays in the learning process. In addition,

the interactive nature of AI tools may encourage students to participate actively in learning activities and sustain their attention, particularly when learning complex concepts in computer networking. The availability of personalized and immediate feedback may also give students opportunities to identify and correct their misunderstandings while completing learning tasks, which can enhance their continued engagement with the learning process. These findings are consistent with the findings of Lunsford et al. (2018), who reported that the use of online learning platforms significantly influenced students' academic and professional trajectories by providing relevant support and learning resources. Similarly, An et al. (2023) found that teachers' and students' behavioural intentions to use AI in educational processes were high, partly because of the perceived usefulness and importance of AI in teaching and learning. The present finding therefore suggests that students' positive perceptions of AI-driven personalized learning may be associated with the tools' capacity to provide interactive learning experiences, personalized support, and timely feedback. In the context of computer networking courses, where students often encounter abstract concepts that require continuous practice and clarification, these capabilities

may be particularly valuable in sustaining students' interest and engagement.

The findings in **Table 2** revealed that digital natives perceived AI-powered personalized learning tools as having a positive influence on their academic achievement, particularly in improving academic performance, problem-solving, and critical-thinking skills. This positive perception may be attributed to the ability of AI-powered personalized learning tools to provide individualized learning experiences that respond to learners' needs, pace, and areas of difficulty. By providing immediate feedback, explanations, and learning resources that can be accessed according to individual learning needs, AI tools may enable students to identify gaps in their understanding and receive appropriate support while learning. The interactive and adaptive nature of these tools may also encourage learners to engage more actively with learning materials, practise problem-solving, and reflect on their understanding, thereby supporting the development of higher-order cognitive skills. These benefits may be particularly relevant to computer networking courses, where learners are required to understand interconnected concepts, analyse problems, and apply theoretical knowledge to practical situations. The finding is consistent with the studies of Maghsudi et al. (2021) and Jian (2023), which reported that AI integration can improve learning outcomes through adaptive feedback and individualized learning pathways. The agreement with these studies suggests that the perceived academic benefits of AI-powered personalized learning may arise from its capacity to provide learners with timely and personalized support rather than presenting the same learning experience to all students. Thus, the present finding provides further evidence that AI-powered personalized learning tools can support learners' cognitive development and engagement with learning materials.

However, despite the perceived benefits of AI-powered personalized learning tools, the findings for Research Question Three revealed several challenges that may hinder their effective adoption. These challenges included institutional resistance, limited digital literacy among educators and learners, the high cost of AI tools, inadequate financial support for research and implementation, and concerns regarding ethical data use and privacy. These challenges may be attributed to the broader institutional and infrastructural conditions within which AI-powered learning is implemented. Limited institutional capacity, inadequate funding, insufficient digital competencies, and the absence of clear policies and guidelines for the responsible use of AI may make institutions and users less prepared to integrate AI tools effectively. Similarly, the cost of accessing appropriate AI technologies, together with concerns about the collection, storage, and use of learners' data, may discourage both institutions and individual users from fully embracing AI-powered personalized learning. These factors suggest that the successful adoption of AI in tertiary education requires more than the availability of AI tools; it also depends on institutional preparedness, digital competencies, financial resources, and appropriate governance mechanisms.

The findings are consistent with Zawacki-Richter et al. (2019) and Ogunode et al. (2023), who identified institutional, technological, and infrastructural barriers as important constraints to the effective adoption of AI in education. The agreement may indicate that challenges associated with AI adoption are not necessarily unique to the learners in the present study but reflect broader conditions surrounding the implementation of emerging technologies in educational institutions. The findings therefore reinforce the need for institutions to strengthen digital infrastructure, improve AI-related competencies among educators and learners, provide adequate financial

support, and establish clear ethical and data-protection guidelines for AI use. The results of the hypothesis testing further complement these findings. The independent-samples *t*-tests showed no significant gender differences in students' perceptions of AI-powered personalized learning tools, their perceived influence on academic achievement, or the challenges associated with adoption. This similarity between male and female students may be explained by their exposure to the same institutional environment, learning resources, technological infrastructure, and AI-related constraints. In other words, students of both genders are likely to encounter similar opportunities and limitations when using AI-powered learning tools within the same educational context. The absence of significant gender differences therefore suggests that the identified barriers may be predominantly systemic and contextual rather than gender-specific, reflecting institutional, technological, financial, and policy-related conditions that affect students irrespective of gender.

Conclusion

This study sought to ascertain the digital natives perception of the impact of AI powered personalized learning on academic achievement as well as possible challenges that might hinders it full adoption in teaching and learning networking courses in education environment. The findings revealed that AI-powered personalized online learning tools significantly enhance students' engagement, motivation, and overall learning experience. Responses indicates that that AI-driven tools makes online learning more interactive, enjoyable, and flexible while providing timely feedback that sustains their interest and commitment to academic tasks. Moreover, the study established that students generally sees AI-based personalized learning as a positive influence on their academic achievement as it enhances problem-solving

skills, critical thinking, and self-directed learning.

Despite the benefits, the study identified several challenges hindering AI adoption, including institutional resistance, high costs of AI tools, limited financial support for AI research, digital literacy gap, and educators' inadequate technological readiness. The study concludes that while AI has immense potential to transform online learning, its full influence depends on addressing contextual barriers and strengthening institutional and human capacities for sustainable adoption. Furthermore, the integration of AI into education represents a transformative shift toward inclusive, adaptive, and learner-centered learning environments. However, its success depends on sustained institutional commitment, capacity building, and ethical governance of AI technologies.

Limitations of the Study

One major limitation of this study is that it focused solely on students and educators' perceptions of AI-powered personalized online learning, excluding administrators whose perspectives could have provided a more holistic understanding of AI adoption challenges. Additionally, the study's sample size was limited to a specific region and may not fully represent the diverse experiences of students across Nigeria's higher education system

Recommendations

Based on the findings regular training programs should be organized for both educators and students to improve their digital literacy, promote AI readiness, and build confidence in using AI-driven learning tools effectively. AI infrastructure and providing financial support for AI powered personalized learning tools as well as encourage student to adopt this tool for learning, development to improve accessibility in resource-constrained settings. Educators should not hinder student in the

application of AI powered tool like ChatGPT for learning. Additionally, socio-cultural factors such as resistance to technology-based education and a preference for traditional learning methods highlight the need for awareness programs and digital literacy training.

Addressing these barriers through institutional support, policy interventions, and capacity-building initiatives will be crucial in ensuring the effective and equitable implementation of AI in personalized online learning. Given that high subscription fees and expensive hardware requirements hinder accessibility, educational institutions should also partner with AI developers to provide subsidized or institution-funded AI learning tools, ensuring affordability for students.

References

- Ajayi, O. (2023). The impact of personalized AI-driven learning paths on student engagement and academic performance at the University of Nigeria. *Journal of Educational Technology*, 15(2), 45–60.
- An, D., Li, C., & Zhou, J. (2023). Teachers' and students' behavioral intentions toward artificial intelligence in education. *International Journal of Emerging Technologies in Learning*, 18(7), 1–15.
- Australian Bureau of Statistics (ABS) 2021 Census Shows Millennials Overtaking Boomers. [(accessed on 15 January 2023)]; Available online: <https://www.abs.gov.au/mediacentre/media-releases/2021-census-shows-millennials-overtaking-boomers>.
- Baker, R. S., & Inventado, P. S. (2016). Educational data mining and learning analytics. In *Learning, design, and technology* (pp. 1–23). Springer.
- Balfour, S. P. (2013). Assessing writing in MOOCs: Automated essay scoring and calibrated peer review. *Research & Practice in Assessment*, 8(1), 40–48.
- Bandura, A. (1977). *Social learning theory*. Prentice Hall.
- Benhamdi, M., Babouri, A., & Chiky, R. (2017). Personalized learning: A new approach for learning in higher education. *International Journal of Learning Management Systems*, 5(1), 12–20.
- Bicknell, J., Chen, Y., & Wu, Y. (2023). Artificial intelligence in education: A systematic literature review. *Computers & Education*, 203, 104120. <https://doi.org/10.1016/j.compedu.2023.104120>
- Bu, Q. (2022). Ethical risks in integrating artificial intelligence into education and potential countermeasures. *Science Insights*, 41(1), 561–566.
- Bundy, A. (2017). Preparing for the future of artificial intelligence. *AI & Society*, 32(2), 285–287. <https://doi.org/10.1007/s00146-016-0685-0>
- Cacicio, T., & Riggs, L. (2023). Artificial intelligence and equitable access in adult education: Developing adaptive learning content. *Adult Learning*, 34(3), 145–158
- Chan, C. K. Y., & Hu, W. (2023). Students' voices on generative AI: Perceptions, benefits, and challenges in higher education. *arXiv preprint*. <https://arxiv.org/abs/2305.00290>

- Chassignol, M., Goksel, A., & Bozkurt, A. (2018). Artificial intelligence in education: A systematic review of the literature. *Journal of Educational Technology & Society*, 21(1), 1–15.
- Chen, Y., Zhang, X., & Liu, J. (2022). The role of personalized AI-driven pathways in enhancing student engagement: A study at the University of Ilorin. *International Journal of Educational Research*, 112(1), 101–115. <https://doi.org/10.1016/j.ijer.2022.101115>
- Christodoulou, E., Kalokairinou, A., Koukia, E., Intas, G., Apostolara, P., Daglas, A., & Zyga, S. (2015). The test-retest reliability and pilot testing of the "new technology and nursing students' learning styles" questionnaire. *International Journal of Caring Sciences*, 8(3), 567.
- Clark, D., Luckin, R., & Cukurova, M. (2019). The role of teachers in the age of artificial intelligence: A review of current research. *Journal of Educational Technology & Society*, 22(4), 1–13.
- Costa, P., García, E., & Perrotta, C. (2023). Artificial intelligence in education: A systematic literature review. *Information Sciences*, 610–611, 123–145. <https://doi.org/10.1016/j.ins.2022.11.021>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
- Education Week. (2024, June). *AI and equity explained: A guide for K–12 schools*. <https://www.edweek.org/technology/ai-and-equity-explained-a-guide-for-k-12-schools/2024/06>
- Fatima, A., Khonturaev, A., & Tapalova, A. (2023). Evaluating the impact of AI-personalized learning systems in higher education. *Journal of Artificial Intelligence, Machine Learning and Neural Network*, 4(5), 22–29. <https://doi.org/10.55529/jaimlenn.45.19.29>
- Fazil, A. W., Hakimi, M., Shahidzay, A. K., & Hasas, A. (2024). Exploring the impact of AI technologies on student engagement and academic performance in university settings in Afghanistan. *RIGGS: Journal of Artificial Intelligence and Digital Business*, 2(2), 56–63.
- Forouzan, B. A. (2017). *Data communications and networking* (5th ed.). McGraw-Hill Education.
- Gasser, U., & Almeida, V. A. (2017). A layered model for AI governance. *IEEE Internet Computing*, 21(6), 58–62.
- Gleason, N. W. (2018). *Higher education in the era of the fourth industrial revolution* (p. 229). Springer Nature.
- Groff, J. (2017). Components and strategies for personalized learning in higher education. *Education Sciences*, 7(3), 273–290.
- Hatice, K. (2025). AI in adult vocational education: Adaptive pathways for flexible learners. *Journal of Continuing Education and Training*, 39(1), 23–36.
- Hollander, J., Sabatini, J., Graesser, A., Greenberg, D., O'Reilly, T., & Frijters, J. (2023). Importance of learner characteristics in intelligent

- tutoring for adult literacy. *Discourse Processes*, 60(4–5), 397–409. <https://doi.org/10.1080/0163853X.2023.2203543>
- Hsu, Y. C., & Ching, Y. H. (2023). Generative artificial intelligence in education, part two: International perspectives. *TechTrends*, 67(6), 885–890. <https://doi.org/10.1007/s11528-023-00913-2>
- Hwang, G. J., Liang, J. C., Su, Y. S., & Chen, C. H. (2014). A systematic review of personalized learning: Theoretical frameworks and applications. *Educational Technology & Society*, 17(3), 1–20.
- Jian, S. (2023). Personalized online learning and adaptive instruction: A case study of AI integration in higher education. *Journal of Educational Research and Practice*, 13(2), 55–67.
- Knowles, M. S. (1984). *The adult learner: A neglected species* (3rd ed.). Gulf Publishing.
- Kurose, J. F., & Ross, K. W. (2019). *Computer networking: A top-down approach* (pp. 607967-5). Harlow, England Boston: Pearson.
- Lin, X., Wang, Y., & Li, J. (2023). Smart education with artificial intelligence: A meta-analysis of adaptive learning systems. *Journal of Educational Computing Research*, 61(4), 678–693.
- Lockspeiser, T. M., & Kaul, P. (2016). Using individualized learning plans to facilitate learner-centered teaching. *Journal of Pediatric and Adolescent Gynecology*, 29(3), 214–217. <https://doi.org/10.1016/j.jpag.2015.10.020>
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.
- Maghsudi, S., Lan, A. S., Xu, J., & van der Schaar, M. (2021). Personalized education in the artificial intelligence era: What to expect next. *IEEE Signal Processing Magazine*, 38(3), 37–50. <https://doi.org/10.1109/MSP.2021.3055032>
- Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education*, 74, 5–12.
- Niknam, M., & Thulasiraman, P. (2020). LPR: A bio-inspired intelligent learning path recommendation system based on meaningful learning theory. *Education and Information Technologies*, 25(5), 3797–3819. <https://doi.org/10.1007/s10639-020-10133-3>
- Ogunode, N. J., Olofu, P. A., & Bassey, U. O. (2023). Barriers to effective usage of artificial intelligence in tertiary institutions in North-Central Nigeria. *Web of Semantics: Journal of Interdisciplinary Science*, 1(1), 38–43
- Panko, R. R., & Panko, J. L. (2015). *Business data networks and security* (pp. 145-147). Harlow, Essex: Pearson.
- Prensky, M. (2001). Digital natives, digital immigrants part 2: Do they really think differently?. *On the horizon*, 9(6), 1-6.
- Razali, S. S., Ismail, A., Yazid, F. M., Ahmad, M. F., Hashim, S., Rohanai, R., & Shafieek, M. S. M. (2023). TVET in the 21st century: Exploring

- multimedia elements in digital teaching and learning. *Journal of Technical Education and Training*, 15(1), 9–19.
- Redecker, C., & Punie, Y. (2017). Digital competence of educators. *Edited by Yves Punie*.
- Rowlands, I., Nicholas, D., Williams, P., Huntington, P., Fieldhouse, M., Gunter, B., ... & Tenopir, C. (2008, July). The Google generation: the information behaviour of the researcher of the future. In *Aslib proceedings* (Vol. 60, No. 4, pp. 290-310). Emerald Group Publishing Limited.
- Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. British Journal of Educational Technology, 50*(3), 1003–1012.
- Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education*, 34(3–4), 177–193. [https://doi.org/10.1016/S0360-1315\(99\)00044-5](https://doi.org/10.1016/S0360-1315(99)00044-5)
- Sherman, R. O. (2009). Teaching the net set. *Journal of Nursing Education*, 48(7), 359-360.
- Sorrentino, P. (2018). The mystery of the digital natives' existence: Questioning the validity of the Prenskian metaphor. *First Monday*. 2018;23 doi: 10.5210/fm.v23i10.9434.
- Stolterman, E., & Fors, A. C. (2004). Information technology and the good life. In *Information systems research: relevant theory and informed practice* (pp. 687-692). Boston, MA: Springer US.
- Tapscott, D. (1998). *Growing up digital* (Vol. 302). San Francisco: McGraw-Hill Companies.
- Ubiminds. (2024). *Equity in artificial intelligence education*. <https://www.ubiminds.com/equity-in-artificial-intelligence-education>
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education—Where are the educators? *International Journal of Educational Technology in Higher Education*, 16, Article 39. <https://doi.org/10.1186/s41239-019-0171-0>