The Impact of Generative AI in Personalized Learning on Students Learning Outcomes; Teachers Perception of Impact of AI in The 21st Century

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DOI : https://doi.org/10.5281/zenodo.15716158

Abstract

This study explores the impact of generative AI integration in personalized learning on student learning outcomes, focusing on teachers' perceptions of AI's role in 21st-century education. A purposive sampling technique was used to survey 250 teachers, who provided insights on how AI influences educational environments. The study employed a descriptive research design of survey type. Primary mode of data collection was adopted using a researcher-structured questionnaire as the research instrument, which was validated, and reliability testing yielded a coefficient of 0.8 using the Spearman-Brown Prophecy Formula. Frequency count and percentage was employed to analyze the demographic data of the respondents while mean score, percentile and standard deviation were used to answer the research questions drawn for the study. The study revealed that teachers perceive generative AI in personalized learning as significantly enhancing student learning outcomes. Specifically, AI-generated personalized content was found to positively influence student engagement and motivation in the learning process. Additionally, the results indicate that teacher digital literacy skills are crucial to effectively implementing generative AI in personalized learning, impacting its success in improving learning outcomes. These findings suggest that investment in AI resources and teacher digital literacy training is essential to fully harness AI's potential in personalized learning and improve student success in the 21st-century classroom. This study further strengthens the knowledge on AI's transformative role in modern classrooms and its potential to support tailored educational experiences geared towards a learning outcome.

Keywords: Generative *AI, Teacher, Student, Impact, Learning outcomes, Perception, 21st-century*

Introduction

In the global world of today, technological innovation and advancement of artificial intelligence has penetrated every sector such as finance, health, business art, fashion and educational sector. In order to improve student understanding and influence learning outcomes, the teaching and learning process has changed as a result of artificial intelligence advancements. Educational facilitators now adopt artificial intelligence to help tailor their curriculum based on individual needs of their student. As AI technologies advance, it becomes increasingly evident how they might change the educational landscape (Yim & Su, 2024). According to Raja et al. (2024), artificial intelligence (AI) has previously unexplored possibilities to strengthen student performance, refining instructional methods, and personalizing learning. AI may provide targeted interventions and create a more engaging and productive learning environment by analyzing enormous volumes of educational information and customizing the educational experience to each student's requirements (Wang et al., 2024).

A revolution driven by AI is about to occur in the field of education. Learning might become more individualized thanks to this technology. Consider AI programs that evaluate a student's learning preferences, areas of strength, and shortcomings. The AI could use this data to customize learning materials, levels of difficulty, and even instructional strategies for every student (Pedro et al., 2019). Sasikala and Ravichandran (2024) opined that it may soon be commonplace to use AI-powered intelligent teaching programs that offer personalized guidance and instant feedback during the learning process. A type of artificial intelligence known as "generative AI" is used to create tailored learning materials that can be modified according to the needs and skill level of an individual students. Evidence that generative AI will be able to tailor learning materials to an individual specific strengths and learning choices by evaluating student data, such as learning style, performance evaluations, and engagement level (Gligorea et al., 2024). One notable advantage of using adaptive AI for tailored learning is that students would be able to handle and understand the material at the right level of difficulty based on their unique performance (Tapalova & Zhiyenbayeva, 2022). The advantages go beyond specific learners. Large volumes of educational data may be analyzed by AI, giving administrators and instructors insightful information. In the end, this data-driven strategy can enhance learning outcomes for everyone by informing educational policy, resource allocation, and instructional practices (Hora et al., 2017). Nevertheless it's crucial to keep in mind that AI is only a tool, and how well it works in the classroom will dictate how widely it is used. Educators can increase the likelihood of success by taking action early and providing concentrated assistance.

The successful integration of AI-driven tailored material in classrooms, which has a direct influence on student learning results, depends heavily on the digital literacy of teachers. Proficiency with technology is only one aspect of higher degrees of digital literacy. In a digital learning or work environment, it entails judiciously and critically managing information, cultivating teamwork and communication abilities, and producing outstanding higher order learning results (Lingga et al., 2022; Su, 2023). Ng, et al. (2023), opined that educational facilitators with strong digital literacy skills are better equipped to navigate, implement, and adapt AI technologies, making it possible to leverage AI's full potential in creating customized learning experiences. One primary issue is the disparity in teachers' familiarity and comfort with generative AI. Many educators lack adequate training on its applications, benefits, and limitations, which affects their confidence in utilizing these tools effectively. Without sufficient knowledge, teachers may either underutilize AI tools or

avoid them altogether, depriving students of personalized learning pathways that could support academic improvement (Anurogo et al., 2023).

AI in the educational sector promises an exciting future. Its potential ability to improve learning outcomes is one of its most significant benefits. Students can better understand subjects when they get individualized training based on their unique strengths and shortcomings. Teachers may deliver focused interventions and make sure everyone realizes their full potential by using AI to identify kids who might require further support (Sasikala & Ravichandran, 2024). AI has the potential to greatly increase classroom productivity. According to Gökçearslan et al. (2024), Teachers may devote more time to the things that truly count, which include developing students and providing stimulating learning experiences by optimizing administrative tasks like attendance tracking and grading. AI can improve access to educational materials, guaranteeing that all students have easy accessibility to useful learning materials and tools. Dynamic and interactive material produced by generative AI engages students and improves the effectiveness, immersion, and engagement of education (Hartley, 2023). It has opened the door for a paradigm change in the way teachers create and present curricula. Teachers can abandon the standard method of teaching and adopt a student-focused paradigm provided they are able to provide varied and suitable learning resources (Ko et al., 2022). The use of generative AI into customized learning offers great promise for improving student results by providing individualized educational experiences, Teachers' views and impressions of this technology's use, however, have a significant influence on its impact and may either help or impede its acceptance and efficacy in the classroom (Lee & Song, 2024). Notwithstanding its promise, there are significant obstacles brought about by different teacher perspectives on generative AI, which might result in uneven application and less than ideal student learning outcomes (Kaplan-Rakowski et al., 2023).

Perception is the process by which people understand and make meaning of whatever sensory information they receive from their environment (Merleau-Ponty, 2004). It involves recognizing, organizing, and interpreting stimuli based on past experiences, beliefs, emotions, and knowledge. In a research context, studying perception helps to understand individuals' attitudes, beliefs, and biases toward specific subjects or phenomena, providing insights into how people may respond to or engage with new ideas, technologies, or environments. Positive perceptions among teachers often stem from AI's potential to boost student motivation and engagement by offering unique, adaptive content. AI’s ability to provide instant feedback and resources tailored to each student can help reduce learning gaps and promote continuous progress. Some teachers see AI as a way to save time on lesson planning and assessments, giving them more bandwidth to focus on student interaction and support. However, teachers' perceptions can vary based on their digital literacy skills. Educators with higher digital literacy are generally more open to integrating AI and can navigate its functions effectively, which makes them more likely to perceive AI as a beneficial addition to the classroom. In contrast, teachers with limited experience in digital tools may view AI integration as a challenge, potentially concerned about technical issues or the possibility of over-reliance on technology.

The utilization of generative AI in personalized learning has introduced transformative shifts in educational outcomes, promising tailored learning experiences that meet individual student needs. This technology adapts content based on student progress, comprehension levels, and learning preferences, allowing for dynamic and engaging learning environments that support varied paces and styles. Proponents argue that personalized AI-driven learning can improve engagement, deepen comprehension, and enhance retention, as students are

presented with content suited to their unique learning profiles. Additionally, AI enables continuous feedback, helping students understand areas of improvement and fostering a sense of progression and accomplishment.

However, while the benefits are significant, there are also critical concerns. Overreliance on AI in educational settings may limit opportunities for critical thinking and interpersonal skills development, as students may become too dependent on the technology's guidance. Moreover, the personalization algorithms may unintentionally reinforce existing biases or limit students' exposure to diverse viewpoints if they narrow content based on past performance data. Privacy is another issue, as the vast amounts of personal data required for AI-driven customization raise concerns about data security and student autonomy (Vaza et al., 2024). Thus, while generative AI offers innovative solutions in personalized learning, these challenges need addressing to ensure its positive impact on learning outcomes is holistic and equitable. Thus, this study aims to assess teacher's perception on the impact of generative AI in personalized learning on students learning outcomes. The following research questions were drawn to assess teacher's perception on the study variables;

RQ1: Does generative AI integration in personalized learning environments impact student learning outcome?

RQ2: Does AI-generated personalized content influence student engagement and motivation in the learning process?

RQ3: Does teachers' digital literacy impact the effectiveness of generative AI personalized learning on student learning outcomes?

Methods

The study employed a descriptive survey research design. A customized questionnaire developed by the researcher was utilized as the primary instrument for data collection. The purposive sampling technique was adopted to select 250 teachers from Lagos State, Nigeria, ensuring that respondents were chosen based on their expertise and experience relevant to the research focus. The participants comprised experienced educators who integrated both conventional teaching methods and generative AI technologies to enhance learning outcomes. The questionnaire consisted of two sections: Section A gathered demographic information about the respondents, while Section B addressed the research questions using a four-point Likert scale (Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1). The instrument underwent a validation process, and reliability testing produced a coefficient of 0.80, calculated using the Spearman-Brown Prophecy Formula. Data analysis involved frequency counts and percentages to summarize demographic information. Mean scores and standard deviations were used to interpret the responses to the research questions, ensuring a robust understanding of the data.

Results

This section of the result presents the analysis of respondents' demographic data, focusing on key variables such as work experience, gender and age. The data were analyzed using frequency counts and percentages to provide a clear and concise summary of the respondents' characteristics.

Table 1: Frequency distribution of the study participant

S/N	Demographics	Frequency	Percentage (%)
1	**Age**		
	20-30 Years	86	34.4
	31-40 Years	95	38
	40 years and above	69	27
	Total	**250**	**100.0**
2	**Gender**		
	Male	132	52.8
	Female	118	47.2
	Total	**250**	**100.0**
3	**Work experience**		
	1-6 years	98	39.2
	7-11 years	103	41.2
	12 years and above	49	19.6
	Total	**250**	**100.0**

Sources: Field Survey, 2024

Table 1 reveals the age distribution of the respondents. A total of 86 participants (34.4%) were aged 20–30 years, 95 respondents (38%) fell within the 31–40 years range, and 69 individuals (27%) were aged 41 years and above. These findings indicate that the majority of the respondents were in the 31–40 years age group. Table also illustrates the gender distribution of the respondents, with 132 males (52.8%) and 118 females (47.2%). These results indicate that the majority of participants in the study were male. Furthermore, the Table also provides an overview of the respondents' work experience. It shows that 98 participants (39.2%) had 1–6 years of experience, 103 respondents (41.2%) had 7–11 years of experience, and 49 participants (19.6%) had more than 12 years of experience. These findings indicate that the largest proportion of respondents fell within the 6–10 years of work experience category.

Analysis of the Research Questions

RQ 1: Does generative AI integration in personalized learning environments impact student learning outcome?

Table 2: Mean Rating, Standard Deviation and percentile of Respondents on the impact of generative AI in personalized learning environments on student learning outcome?

S/N	Statements	Agree (SA) (A)	Disagree (D) (SD)	Mean Score	STD	Major Remark
1.	I believe integrating generative AI into personalized learning improves students' overall academic performance.	218 (87.2%)	32 (12.8%)	3.50	0.56	(87.2%) Agreed
2.	Generative AI enhances students' ability to grasp complex concepts more effectively in a personalized learning environment.	233 (93.2%)	17 (6.8%)	3.76	0.59	(93.2%) Agreed
3.	The use of generative AI in creating individualized learning paths positively influences students' critical thinking skills.	236 (94.4%)	14 (5.6%)	3.79	0.66	(94.4%) Agreed
4.	The use of generative AI in creating individualized learning paths positively influences students' critical thinking skills.	229 (91.6%)	21 (8.4%)	3.68	0.63	(91.6%) Agreed
5.	I think generative AI's role in personalized learning environments prepares students better for future academic challenges.	207 (82.8%)	43 (17.2%)	3.32	0.59	(82.8%) Agreed

Table 4 provides the mean scores, standard deviations, and percentile distributions related to the impact of integrating generative AI into personalized learning environments on student learning outcomes. The data show that all items have mean scores above the midpoint of 2.50, with a majority percentage of 50% or higher, suggesting that most respondents agreed with the statements. Responses in the opposite direction were considered less significant. These findings indicate that the majority of participants recognize the positive impact of incorporating generative AI into personalized learning environments on student learning

outcomes. Thus, it can be concluded that most respondents believe that this integration enhances student performance.

RQ 2: Does AI-generated personalized content influence student engagement and motivation in learning process?

S/N	Statements	Agree (SA) (A)	Disagree (D) (SD)	Mean Score	STD	Major Remark
1.	AI-generated personalized content increases students' interest and participation in learning activities	207 (82.8%)	43 (17.2%)	3.32	0.68	(82.8%) Agreed
2.	Students are more likely to remain focused and attentive when engaging with AI-generated tailored learning materials.	211 (84.4%)	39 (15.6%)	3.25	0.54	(84.4%) Agreed
3.	AI-powered content that is tailored to each student encourages them to take charge of their education.	223 (89.2%)	27 (10.8%)	3.89	0.59	(89.2%) Agreed
4.	Generative AI content fosters curiosity and encourages students to explore beyond the standard curriculum.	230 (92%)	20 (8%)	3.68	0.61	(92%) Agreed
5.	I believe AI-personalized materials can enhance classroom dynamics due to students' enthusiasm.	231 (92.4%)	15 (7.6%)	3.77	0.64	(92.4%) Agreed

Table 3: Mean Rating, Standard Deviation and percentile of Respondents on the influence of AI-generated personalized content on student engagement and motivation in learning process

Table 3 provides an analysis of the mean scores, standard deviations, and percentile remarks concerning the influence of AI-generated personalized content on student engagement and motivation in the learning process. The results indicate that all items have mean scores exceeding the midpoint of 2.50, with a majority percentage of 50% or higher. This suggests that most respondents agreed with the statements presented. Responses opposing this view were considered less significant. These findings highlight that the majority of participants acknowledge the positive influence of AI-generated personalized content on enhancing student engagement and motivation in learning. Therefore, it can be concluded that the teacher perceived that integration of such content has a significant impact on students' active participation and enthusiasm for learning.

RQ 3: Does teachers' digital literacy impact the effectiveness of generative AI personalized learning on student learning outcomes?

Table 4: Mean Rating, Standard Deviation and percentile of Respondents on the impact of teachers' digital literacy on the effectiveness of generative AI personalized learning on student learning outcomes?

S/N	Statements	Agree (SA) (A)	Disagree (D) (SD)	Mean Score	STD	Major Remark
1.	A teacher's ability to effectively use AI tools significantly impacts the success of personalized learning outcomes.	245 (98%)	5 (2%)	3.22	0.74	(98%) Agreed
2.	Lack of digital literacy among teachers limits the potential benefits of generative AI in personalized learning.	247 (98.80%)	3 (1.2%)	3.98	0.56	(98.8%) Agreed
3.	Proficiency in digital technologies enables educators to optimize the advantages of artificial intelligence in the classroom.	244 (97.60%)	6 (2.4%)	3.79	0.66	(97.6%) Agreed
4.	Continuous professional development in AI tools enhances teachers' confidence in utilizing AI-driven learning solutions.	241 (96.40%)	9 (3.6%)	3.87	0.65	(96.4%) Agreed
5.	For generative AI to be successfully incorporated into education, I think it is imperative that teachers receive training in digital literacy.	243 (97.20%)	7 (2.8%)	3.32	0.59	(97.2%) Agreed

Table 4 provides an analysis of the mean scores, standard deviations, and percentile remarks regarding the impact of teachers' digital literacy on the effectiveness of generative AI-driven personalized learning in improving student learning outcomes. The data reveal that all items have mean scores above the midpoint value of 2.50, with a majority percentage exceeding 50%. This indicates that most respondents agreed with the statements. Opposing responses were minimal and deemed less significant. These findings suggest that the majority of participants recognize the crucial role of teachers' digital literacy in enhancing the effectiveness of generative AI-based personalized learning systems in achieving positive student outcomes.

Therefore, it can be inferred that teachers' proficiency in digital skills significantly contributes to the success of such innovative learning approaches.

Discussion of Findings

Table 2 present the result on the impact of generative AI into personalized learning environments on student learning outcome. The result showed that the integration of generative AI into personalized learning environments impact student learning outcomes. A possible reason for this finding is that teacher understands that generative AI can tailor content and instruction to meet each student's unique needs, abilities, and learning pace. Teachers recognize that by customizing learning materials, AI can address specific knowledge gaps, reinforce concepts in areas where students struggle, and offer advanced material for those who excel. This level of personalized support may lead to higher engagement and understanding, ultimately improving learning outcomes. The findings of Li et al. (2024) corroborate with findings of this research, their study showed that generative AI technology can maximize learning outcomes, boost student engagement and happiness, and dramatically increase learning efficiency. It has been demonstrated that this degree of customization promotes greater efficacy, relevance, and engagement, which leads to better learning outcomes (Chanaa et al, 2018). According to Elmourabit et al.'s study from 2024, generative AI has the ability to enhance learning and evaluation procedures, as long as instructors are actively involved. The use of ChatGPT, an AI chatbot, to improve online student participation in sociology and politics education was investigated by Al Yakin et al. (2023).

According to the study, ChatGPT produced excitement and a high degree of student involvement. In particular, ChatGPT helped students with tasks like brainstorming, debates, analysis, and inspiration. The impact of adaptive learning technology on student accomplishment in many educational situations has been the subject of meta-analyses. According to the study, students who used adaptive learning systems outperformed those who received traditional teaching by an average of 0.35 standard deviations in their learning outcomes (Kulik & Fletcher, 2016). Blessing's report (2024) According to a research done at Arizona State University, AI-enabled adaptive learning significantly improved student performance and retention in arithmetic classes. A significant improvement in pass rates and a 25% rise in student retention were the results of the university's adaptive system, which employs AI to modify course contents in real-time. Guettala (2024) The paper demonstrates concrete advantages of generative AI integration through a thorough examination of a few chosen case studies, such as enhanced learner's participation, better grades, and quicker skill development. Even while students who used AI-generated study materials saw improvements in their test scores and grades, some of them did not profit from them (Binhammad et al. 2024). These are a few outcomes that highlight how crucial it is to take into account things like the learners enthusiasm, previous experience, and the caliber of the algorithm being used while adopting generative AI in the classroom.

Table 3 presents the result on the impact of generative AI into personalized learning environments on student learning outcome. The result showed that AI-generated personalized content affects student engagement and motivation in the learning process. One possible reason for the results of this study is that AI-supported customized learning can boost student motivation by making lessons or lectures more interesting and relevant.. Teachers recognize that when students feel that their learning journey is tailored to their interests and skill levels, they are more likely to engage fully, which leads to improved academic performance. The findings is corroborated with Pesovski's (2024) research, students found generative AI in a variety of learning materials to be highly engaging. Even though students were mostly using the conventional version of the

course materials, they thought this method was interesting and inspiring. According to Owoseni's study (2024), when AI is applied properly, it improves education's adaptability, engagement, and inclusivity. The study also emphasizes that while AI cannot replace teachers, it may be a useful tool in the pursuit of more dynamic and responsive teaching and learning environments. In contrast to students in conventional classroom settings, Aleven et al. (2016) discovered that students utilizing an AI-powered adaptive learning system had noticeably better degrees of enthusiasm and engagement.

Table 4 presents the result on the impact of teachers' digital literacy on the effectiveness of generative AI personalized learning on student learning outcomes. The result showed that majority of the respondents agreed that teacher's digital literacy impact the effectiveness of generative AI personalized learning on student learning outcomes. A possible explanation to this is that teachers with strong digital literacy skills are better equipped to navigate and utilize generative AI tools effectively. They can understand the full range of features available, select appropriate tools for different learning scenarios, and customize AI-driven resources in ways that truly benefit students. Without these skills, teachers might underutilize or misuse AI capabilities, reducing its potential impact on learning outcomes. Digital literacy enables teachers to fine-tune and personalize the content generated by AI systems. Teachers who are digitally skilled can better judge the appropriateness, accuracy, and relevance of AI-generated materials and incorporate them to fit the specific needs and levels of their students. This results in more meaningful and impactful personalized learning experiences that are aligned with students' goals. The results of this study are comparable to those of Chen, Chen, and Lin (2020), who found that AI technologies may be used to finish time-consuming administrative duties related to teaching and learning without compromising task quality. Thus, by adopting AI technology to save time on these tasks, instructors may concentrate on satisfying the learning needs of their pupils. According to research by Chiu, Moorhouse, et al. (2023) and Yang et al. (2020), interactions between humans and robots or chatbots make students who have low self-confidence or struggle academically feel less embarrassed and more courageous when they face difficulties. Students' academic performance is greatly enhanced by this (Kim et al., 2021). Kadaruddin's (2023) findings and talks highlight several educational advantages of generative AI. By utilizing Generative AI, educators may provide interactive material, tailor learning experiences, and enable adaptive evaluations. Learner engagement and information retention may be improved by this tailored approach.

The research findings have an important ramification for teacher's preparation, legislation, and educational practice. The positive impact of generative AI on personalized learning outcomes indicate that schools need to think about integrating AI-driven tools into their curricula to foster more tailored learning experiences. Schools and policymakers can leverage this insight to allocate resources for the implement/tation of artificial intelligent in to school settings, which can be tailored to individual students' needs, thereby improving overall learning effectiveness. The significance of content customization in contemporary education is demonstrated by the observed impact of AI-generated tailored material on student motivation and engagement. According to this realization, AI has the ability to make a big difference in creating a more engaging, pertinent, and encouraging learning environment. Educational software developers should prioritize AI tools that facilitate adaptive content delivery and engage students based on their unique preferences and learning progressions. Furthermore, the finding that teacher digital literacy skills affect the effectiveness of generative AI underscores the need for targeted professional development in AI literacy. Teacher training programs should prioritize digital literacy and AI-specific skill-building to ensure educators can confidently integrate and leverage AI tools in personalized learning. By addressing this need, training institutions and school administrators can help teachers maximize AI's potential benefits on student outcomes.

Conclusion

This research reflects on the positive perceptions that teachers hold toward the integration of generative AI in personalized learning environments. The results indicate that generative AI can substantial improve student learning outcomes, improve engagement, and foster motivation through personalized content delivery. However, teachers' proficiency with AI and digital literacy is of necessity for effective deployment of these AI-driven solutions in classrooms. In order to fully utilize AI in personalized learning, there is a clear need for strategic investment in both AI tools and teacher training initiatives focused on AI competencies. The study's findings reflect on the importance of artificial intelligence in the educational sector by showcasing how crucial teacher preparedness is to the successful implementation of AI-driven solutions that enhance student learning outcomes in classrooms of the twenty-first century.

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