

AI-ENABLED PERSONALIZED E-LEARNING AND STUDENT ENGAGEMENT: OPPORTUNITIES, CHALLENGES AND FUTURE READINESS

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ABSTRACT

The present study examines AI-enabled personalized e-learning and its influence on student engagement in the context of future-ready digital education. The study focuses on students' use of personalized learning, AI-based feedback, platform quality and digital readiness. A quantitative research approach with a descriptive research design is adopted for the study. Primary data is collected from 250 undergraduate and postgraduate students through a structured questionnaire using a five-point Likert scale, while secondary data is collected from journals, books, research articles and reliable educational sources. The gathered data is analyzed using percentage analysis, the Chi-Square test, one-way ANOVA, and multiple regression analysis. The results indicate that students regularly utilize AI-enabled personalized e-learning platforms, with 47.2% of respondents using them on a daily basis. The Multiple Regression analysis reveals that personalized learning, AI-based feedback, platform quality, and digital readiness significantly influence student engagement, with an R² value of 0.612. The Chi-Square result confirms a significant association between AI-enabled personalized e-learning and student engagement. Personalized learning has the biggest impact on student engagement out of all of these elements. The study comes to the conclusion that, when paired with high-quality digital platforms, teacher support, digital preparedness, and responsible usage of AI, learner-centered, flexible, and future-ready education can be supported by AI-enabled individualized e-learning.

Keywords: AI-enabled e-learning, Personalized learning, Student engagement, AI-based feedback

I. INTRODUCTION

The expansion of digital education has created new possibilities for teaching and learning the traditional classroom. Students can access lectures, videos, digital texts, tests, discussion boards, simulations, and evaluations at any time and from any location thanks to e-learning platforms. "Transformative Education and Future Learning" is included as one of the main tracks in the conference brochure, which highlights digital innovation and transformative education. Additionally, it emphasizes the significance of multidisciplinary research in developing technologies like artificial intelligence, data analytics, automation, and smart

technology. Personalized e-learning has emerged as a key area for education in this context. Personalized systems can leverage learner activity, performance, and preferences to suggest appropriate content, activities, and feedback rather than giving every student the exact same learning sequence. Adaptive learning, intelligent tutoring, automated feedback, and learning resource recommendations can all be supported by AI-based technologies. These advancements may assist pupils advance at a suitable rate and increase learner engagement.

However, improved learning cannot be ensured by technology alone. Information overload, low motivation, unequal access to gadgets and connectivity, privacy concerns, or an over-reliance on automated systems are all possible outcomes for students. In order to properly employ AI tools and analyze learning metrics, educators must also possess the necessary digital skills. Therefore, the key question is not just whether AI can customize e-learning, but rather how to do it in a way that is learner-centered, moral, inclusive, and instructional. Therefore, this study focuses on AI-enabled tailored e-learning and student engagement, analyzing key stakeholders' perceptions of its advantages, difficulties, and preparedness for the future.

II. OBJECTIVES OF THE STUDY

1. To assess the level of awareness and use of AI-enabled personalized e-learning among students.
2. To investigate how students view individualized digital learning in terms of engagement, motivation, and ease of learning.
3. To determine the main obstacles to AI-enabled e-learning, such as digital preparedness, privacy, accessibility, and reliance on technology.
4. To determine whether there are notable differences in respondent groups' perspectives of individualized e-learning.
4. To provide strategies for integrating responsible, learner-centered, and inclusive AI-enabled e-learning in higher education.

III. NEED FOR THE STUDY

1. The increasing use of digital platforms has created a need to understand whether technology is improving meaningful student engagement.
2. Personalized learning can support different learning speeds and preferences, but its effectiveness depends on learner readiness and appropriate instructional design.
3. To effectively employ new e-learning technologies, educators and students need to be digitally and artificial intelligence literate.
4. To strike a balance between computerized personalization, teacher assistance, and human connection, institutions require evidence-based strategies.

IV. REVIEW OF LITERATURE

Huang, Lu and Yang (2023) investigated the impact of tailored recommendations offered by artificial intelligence on students' motivation, engagement, and learning results in a flipped classroom setting. The study classified students based on their motivation levels using data from learning management systems and tailored video recommendations. The results showed that learning outcomes and engagement could be enhanced by AI-based personalized recommendations, especially for learners with moderate motivation. The study shows how recommendation systems can offer students appropriate content based on their unique learning needs.

Wu et al. (2024) carried out a thorough investigation of personalized learning in smart education, concentrating on personalized recommendation systems and student modeling. The study emphasized artificial intelligence's expanding importance in comprehending learners' choices, skills, and learning needs. It highlighted that by utilizing student data and recommendation technology, personalized learning can advance education beyond a standardized "one-size-fits-all" approach. The writers also covered implementation and assessment issues as well as the necessity of including both cognitive and non-cognitive learning components into individualized educational programs.

Laak and Aru (2024) investigated the connection between individualized learning and artificial intelligence within the framework of modern educational goals. According to their research, learning performance can be enhanced by AI-based personalized learning systems, but personalization should go beyond just providing tailored content. Collaboration, cognitive engagement, and broader learner competencies were highlighted by the writers. Instead of using AI to replace human connection, they suggested a hybrid strategy where AI works in tandem with educators and collaborative learning.

Long, Wang, Rashid and Lu (2025) conducted a systematic review of 73 peer-reviewed studies examining the impact of artificial intelligence on student engagement in higher education. Personalized learning systems, adaptive tutoring, real-time feedback, natural language processing tools, and predictive analytics were all noted in the report as significant uses of AI in education. The results showed that thru structured feedback, interactive scaffolding, and personalization, AI may promote behavioral, emotional, and cognitive engagement. But the study also highlighted how crucial teaching strategies are in determining whether or not AI genuinely raises student engagement.

D' Costa (2025) reviewed AI-driven adaptive e-learning systems and their contribution to personalized student engagement. According to the study, adaptive systems are able to continuously analyze learner interactions and modify feedback, learning routes, material, and difficulty levels in accordance with individual needs. Learner modeling, adaptive material delivery, predictive analytics, and real-time feedback were recognized by the evaluation as key elements of AI-based personalized learning. However, issues with algorithmic transparency,

data privacy, and technology infrastructure were shown to be significant obstacles to effective deployment.

Zhou (2025) reviewed the role of artificial intelligence in student engagement in online learning and identified several major applications, including chatbots, learning analytics, personalized feedback, recommendation systems and AI-supported smart learning environments. The analysis highlighted that because students need more autonomy and self-control, student engagement is more difficult in online learning. Promising strategies for increasing engagement were found to be AI-based personalization and prompt feedback; nevertheless, successful implementation necessitates careful consideration of learner needs and educational context.

Xu, Liu and Li (2025) investigated how AI-driven personalized feedback influences goal achievement, self-efficacy and learning engagement among college students. The study used data from 1,079 Chinese college students to investigate, from a self-determination theory perspective, the relationship between academic achievement, motivation, and tailored AI feedback. According to the study, when AI technologies are properly included into learning procedures, tailored feedback can significantly boost students' motivation and engagement.

V. RESEARCH METHODOLOGY

The present study adopts a quantitative research approach to examine the influence of AI-enabled personalized e-learning on student engagement and future learning. The study focuses on how students see digital learning experiences, adaptive learning, AI-based recommendations, tailored content, and feedback. To get thorough information about the study, both primary and secondary data are employed. To analyze the gathered data and accomplish the study's goals, statistical methods are used.

DATA COLLECTION METHODS:

The study is based on both primary and secondary data collection methods. Primary data is collected from students who actively use e-learning platforms through a structured questionnaire containing closed-ended statements measured on a five-point Likert scale. Personalized learning, AI-based suggestions, learner engagement, digital preparedness, platform quality, and difficulties are all covered in the questionnaire. Peer-reviewed journals, books, conference proceedings, research articles, and trustworthy educational databases are the sources of secondary data.

RESEARCH DESIGN:

The research design adopted for the study is descriptive and analytical in nature. In order to comprehend students' attitudes, experiences, and perspectives regarding AI-enabled tailored e-learning, the descriptive design is suitable. Without changing the study variables, it allows the researcher to assess the current level of awareness, utilization, and engagement. Finding

connections and distinctions between particular responder groups is further aided by the analytical method.

SAMPLING TECHNIQUE:

The Simple Random Sampling Technique is used to select the respondents for the study. This approach gives every student who regularly uses e-learning platforms an equal chance to take part in the poll. This method enhances the dependability and representativeness of the gathered data while lowering selection bias. Additionally, it allows the researcher to get feedback from students with varying degrees of familiarity with digital learning.

SAMPLE SIZE:

The sample size of the study consists of 250 respondents. The respondents include undergraduate and postgraduate students who regularly use e-learning platforms for their academic learning. For statistical analyzes such the Chi-Square Test, Multiple regression, and Percentage Analysis used in this research.

SAMPLE UNIT:

The sampling unit of the study comprises individual undergraduate and postgraduate students enrolled in higher educational institutions. One unit of analysis for the study is represented by each student who actively uses e-learning platforms. Data is gathered about their engagement, motivation, AI usage, individualized learning experiences, and difficulties with digital learning. Therefore, the study's main source of data is each individual responder.

TOOLS FOR DATA COLLECTION:

A structured questionnaire using a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1) is used as the main data collection instrument. Demographic data and statements about AI-enabled personalization, learner engagement, platform quality, digital readiness, and perceived difficulties are included in the questionnaire. IBM SPSS Statistics and Microsoft Excel are used to code, tabulate, and analyze the gathered responses. To achieve the study's goals, the results are interpreted using the proper statistical methods.

VI. DATA ANALYSIS AND INTERPRETATION

Table 1: Percentage Analysis of Frequency of Using AI-Enabled Personalized E-Learning Platforms

FREQUENCY OF USE	FREQUENCY	PERCENTAGE (%)
DAILY	118	47
WEEKLY	72	29
MONTHLY	38	15
OCCASIONALLY	22	9
TOTAL	250	100

INTERPRETATION:

The table indicates that 47.2% of the respondents use AI-enabled personalized e-learning platforms daily, followed by 28.8% who use them weekly. Only 8.8% of learners access the platforms occasionally. This indicates a high degree of uptake and consistent engagement in AI-enabled digital learning, as the majority of respondents regularly utilize personalized e-learning platforms.

Table 2: Chi-Square Analysis between AI-Enabled Personalized E-Learning and Student Engagement

PARTICULARS	VALUE
CALCULATED CHI-SQUARE VALUE	16.842
DEGREES OF FREEDOM	6
TABLE VALUE (5% LEVEL)	12.592
SIGNIFICANCE LEVEL	0.05
RESULT	SIGNIFICANT

INTERPRETATION:

The calculated Chi-Square value (16.842) is greater than the table value (12.592) at the 5% level of significance. As a result, the alternative hypothesis is accepted and the null hypothesis is rejected. This suggests that student engagement and AI-enabled tailored e-learning are significantly correlated. As a result, using tailored digital learning tools greatly encourages student involvement and engagement.

Table 3: Multiple Regression Analysis of Factors Influencing Student Engagement

MODEL SUMMARY

MODEL	R	R ²	ADJUSTED R ²	STD. ERROR
1	0.782	0.612	0.606	0.623

ANOVA

SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F VALUE	SIG.
REGRESSION	257.040	4	64.260	165.521	0.000
RESIDUAL	95.960	245	0.392	—	—
TOTAL	353.000	250	—	—	—

COEFFICIENTS

VARIABLE	B	STD. ERROR	BETA (B)	T	SIG. VALUE	P
CONSTANT	0.842	0.214	—	3.935	0.000	
PERSONALIZED LEARNING	0.328	0.056	0.342	5.842	0.000	
AI-BASED FEEDBACK	0.274	0.056	0.286	4.916	0.000	
PLATFORM QUALITY	0.196	0.053	0.205	3.721	0.000	
DIGITAL READINESS	0.143	0.053	0.148	2.684	0.008	

INTERPRETATION:

The Multiple Regression results show an R^2 value of 0.612, indicating that 61.2% of the variation in student engagement is explained by personalized learning, AI-based feedback, platform quality and digital readiness. The regression model as a whole is statistically significant, according to the significance value of 0.000. The coefficient results show that Personalized Learning has the highest positive influence on student engagement with a Beta value of 0.342, followed by AI-Based Feedback (0.286), Platform Quality (0.205) and Digital Readiness (0.148). The significance values of all variables are less than 0.05, indicating that all four factors have a significant influence on student engagement. The elements that have the biggest positive impact on student engagement are personalized learning, AI-based feedback, platform quality, and digital preparedness. As a result, AI-enabled tailored e-learning elements greatly enhance student engagement.

VII. FINDINGS

The study findings indicate that AI-enabled personalized e-learning is widely used by the respondents, with 47.2% using the platforms daily and 28.8% using them weekly. AI-enabled personalized e-learning and student engagement are significantly correlated, according to the Chi-Square analysis, since the computed value of 16.842 is higher than the table value of 12.592 at the 5% level. Personalized learning, AI-based feedback, platform quality, and digital readiness all have a major impact on student engagement, according to the Multiple Regression analysis. These characteristics account for 61.2% of the variation in student engagement, with an R^2 value of 0.612. The factors that have the biggest impact are digital preparedness, platform quality, AI-based feedback, and personalized learning.

VIII. SUGGESTIONS

1. To increase student interest and participation, educational institutions should offer more AI-enabled individualized learning resources.
2. Based on each student's unique learning requirements and skills, e-learning platforms ought to offer tailored content and learning suggestions.

3. To assist students in identifying their learning challenges and enhancing their performance, AI-based instant feedback and evaluation tools ought to be integrated.
4. To give students a better digital learning experience, educational institutions should enhance the quality, usability, and accessibility of e-learning platforms.
5. Students and teachers should participate in regular AI and digital literacy programs to enhance their proficiency with customized e-learning tools.
6. While gathering and analyzing student learning data, educational institutions should guaranty data security, privacy, and appropriate usage of AI.
7. By combining human guidance with AI-based personalization, educators can continue to actively participate in AI-enabled learning.
8. To enable students with varying degrees of digital preparedness to participate successfully, institutions should offer sufficient digital infrastructure and technical support.

IX. CONCLUSION

The study concludes that AI-enabled personalized e-learning plays an important role in improving student engagement and supporting future-ready digital education. The results demonstrate that frequent usage of customized e-learning platforms is linked to increased student engagement, and that students' learning experiences are greatly influenced by personalized learning, AI-based feedback, platform quality, and digital preparedness. The most significant factor is personalized learning, which emphasizes the significance of tailoring instructional materials to each student's needs. In order to build efficient, inclusive, and learner-centered learning environments in the future, educational institutions should bolster AI-enabled e-learning facilities while guaranteeing high-quality platforms, digital preparedness, teacher support, and responsible usage of AI.

X. REFERENCES

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