JOURNAL OF ENGINEERING TECHNOLOGY AND SCIENCE INTEGRATION

journal homepage: https://nordeoscholar.com/jetsi

E-ISSN: 3164-5208

The Adoption of Generative AI in Academic Information Systems: Impacts on User Satisfaction and Learning Efficiency

Dybio Dompu Hot Asih[1*], Erbin Sitorus[2], Jasael Simanullang[1], Jevantree Bate'e[1]

[1] Information Systems Study Program, Universitas Wirahusada Medan, Medan, Indonesia

[2] Information Systems Study Program, Universitas Audi Indonesia, Medan, Indonesia

ARTICLE INFO

Article history:
Received 8 June 2026
Revised 23 June 2026
Accepted 25 June 2026
Published online 30 June 2026

Keywords:
Generative AI; Academic Information Systems; User Satisfaction; Learning Efficiency; Digital Transformation

Editor: Fandi Achmad
Publisher's note: The publisher remains neutral regarding jurisdictional claims in published maps and institutional affiliations, while the author(s) bear sole responsibility for the accuracy of content and any legal implications

ABSTRACT

The rapid advancement of Generative Artificial Intelligence (Generative AI) has significantly transformed academic information systems by enhancing learning processes, academic services, and user interaction. This study aims to analyze the adoption of Generative AI in academic information systems and examine its impacts on user satisfaction and learning efficiency in higher education environments. The research employs a quantitative approach using survey data collected from university students and academic users who actively utilize AI-based academic platforms. Structural Equation Modeling (SEM) is used to evaluate the relationships between Generative AI adoption, system usability, user satisfaction, and learning efficiency. The findings indicate that the adoption of Generative AI positively influences user satisfaction through improved accessibility, personalization, and responsiveness of academic information systems. Furthermore, Generative AI significantly enhances learning efficiency by supporting faster information retrieval, adaptive learning experiences, and academic task automation. The study contributes to the growing literature on artificial intelligence adoption in educational information systems and provides practical implications for universities seeking to implement AI-driven digital transformation strategies. The results also highlight the importance of system quality, trust, and user readiness in maximizing the effectiveness of Generative AI technologies in higher education.

1. Introduction

The rapid advancement of digital technologies has fundamentally transformed higher education systems worldwide, particularly through the integration of Artificial Intelligence (AI) into academic information systems. Universities are increasingly adopting digital technologies to improve educational quality, administrative efficiency, and user experiences in response to the demands of the digital era (Bond et al., 2022). Among recent technological innovations, Generative Artificial Intelligence (Generative AI) has emerged as a transformative technology capable of generating human-like text, images, recommendations, and automated responses that support both academic and administrative processes (Dwivedi et al., 2023). The emergence of applications such as ChatGPT, Gemini, Claude, and other large language model (LLM)-based systems has accelerated the adoption of AI technologies in educational environments, creating new opportunities for enhancing teaching, learning, and academic services (Kasneci et al., 2023).

The growing adoption of Generative AI in higher education reflects the increasing demand for intelligent, adaptive, and personalized learning environments. Traditional academic information systems primarily function as repositories of academic data and administrative services; however, recent developments have expanded their capabilities to include intelligent tutoring, automated content generation, predictive analytics, and personalized learning support (Tlili et al., 2023). Through these capabilities, Generative AI enables academic systems to provide real-time assistance, customized learning recommendations, and efficient information retrieval, thereby enhancing students'

.

*Corresponding Autor: dybio.dompu@gmail.com (Asih, D. D. H.)

learning experiences and institutional service quality (UNESCO, 2023).

Digital transformation initiatives within higher education institutions have further accelerated the integration of AI technologies into academic ecosystems. Universities face increasing challenges related to student engagement, learning effectiveness, academic workload management, and operational efficiency. Consequently, educational institutions are seeking innovative solutions that can improve both learning outcomes and service delivery processes (Rai & Mishra, 2024). Generative AI offers significant potential to address these challenges by automating routine academic tasks, supporting adaptive learning processes, and facilitating more efficient communication between students and academic stakeholders (Alam, 2022). As a result, AI-powered academic information systems are becoming strategic assets in supporting institutional competitiveness and student-centered learning models (Bond et al., 2022).

Previous studies have highlighted the positive impacts of AI adoption on information system performance and user experiences. According to, AI-based systems can improve system usability, responsiveness, and service personalization, which subsequently enhance user satisfaction (Venkatesh et al., 2022). User satisfaction is widely recognized as a critical success factor in information systems because satisfied users are more likely to continue using technological systems and perceive them as beneficial in achieving their objectives. Within educational contexts, Generative AI contributes to user satisfaction by providing timely assistance, personalized support, and interactive learning experiences that align with students' individual needs and preferences (Kasneci et al., 2023).

In addition to influencing user satisfaction, Generative AI has demonstrated considerable potential in improving learning efficiency. Learning efficiency refers to the ability of students to achieve learning objectives using fewer resources, less time, and greater effectiveness (Crompton & Burke, 2023). AI-powered systems assist students in accessing relevant information more rapidly, generating learning materials automatically, receiving immediate feedback, and completing academic tasks more efficiently. These capabilities reduce cognitive load and administrative burdens while supporting more effective learning processes (Tlili et al., 2023). Consequently, Generative AI is increasingly viewed as an important enabler of intelligent learning environments capable of enhancing educational outcomes and academic productivity.

Despite these potential benefits, the implementation of Generative AI in academic information systems is not without challenges. Concerns related to information accuracy, algorithmic transparency, ethical considerations, privacy protection, and user trust continue to influence the adoption and effectiveness of AI technologies in educational settings (Holmes et al., 2022). Furthermore, successful implementation depends not only on technological infrastructure but also on users' digital literacy, readiness, and willingness to accept AI-supported academic processes (UNESCO, 2023). These factors suggest that understanding users' perceptions and experiences remains essential for maximizing the value of Generative AI within higher education institutions.

Although research on artificial intelligence in education has expanded significantly in recent years, existing studies have primarily focused on AI adoption, e-learning systems, educational technology, or digital transformation as separate research domains (Bond et al., 2022; Crompton & Burke, 2023). Limited empirical research has specifically examined the relationship between Generative AI adoption, user satisfaction, and learning efficiency within the context of academic information systems. Moreover, studies investigating the mediating role of user satisfaction in explaining how Generative AI affects learning efficiency remain relatively scarce, particularly in developing countries where digital transformation initiatives are still evolving (Rai & Mishra, 2024).

Unlike previous studies that examined AI adoption and educational outcomes separately, this study conceptualizes User Satisfaction as a mediating mechanism that explains how Generative AI embedded within Academic Information Systems creates educational value. The study therefore extends the Information Systems Success Model by positioning Generative AI as an intelligent system capability rather than merely a technological tool.

Table 1. Research Gap and Novelty of the Study

Authors	Research Focus	Limitation of Previous Studies	Novelty of This Study
Bond et al. (2022)	Digital transformation in higher education	Focused on educational technologies generally and did not specifically examine Generative AI in Academic Information Systems	Examines Generative AI implementation specifically within Academic Information Systems
Kasneci et al. (2023)	Opportunities and challenges of ChatGPT in education	Primarily conceptual and did not empirically test user satisfaction and learning efficiency relationships	Empirically investigates the impacts of Generative AI on User Satisfaction and Learning Efficiency
Tlili et al. (2023)	ChatGPT adoption in educational environments	Did not evaluate the mediating mechanism explaining how AI affects learning outcomes	Introduces User Satisfaction as a mediating variable
Rai & Mishra (2024)	AI adoption and digital transformation in higher education	Focused on organizational adoption issues rather than user-level outcomes	Analyzes individual-level outcomes through SEM-PLS
This Study	Generative AI Adoption in Academic Information Systems	Integrates TAM, ISSM, and Generative AI perspectives	Develops and validates a mediation model linking Generative AI Adoption, User Satisfaction, and Learning Efficiency in higher education

Based on the identified research gaps, this study offers three primary contributions. First, it investigates Generative AI adoption specifically within Academic Information Systems, a context that has received limited empirical attention in previous studies. Second, it examines the mediating role of User Satisfaction in explaining how Generative AI Adoption enhances Learning Efficiency. Third, the study integrates the Technology Acceptance Model (TAM), Information Systems Success Model (ISSM), and Generative AI perspectives into a single SEM-PLS framework, thereby providing a more comprehensive explanation of AI-enabled educational outcomes in higher education.

Therefore, this study aims to analyze the adoption of Generative AI in academic information systems and examine its impact on user satisfaction and learning efficiency among higher education users. Specifically, the research investigates the direct influence of Generative AI adoption on user satisfaction and learning efficiency, as well as the mediating role of user satisfaction in enhancing learning outcomes. By addressing these relationships, the study seeks to provide a more comprehensive understanding of how AI-driven technologies contribute to educational effectiveness and digital transformation within higher education environments.

Theoretically, this study contributes to the growing body of literature on artificial intelligence adoption, information systems success, and educational technology by integrating Generative AI perspectives into academic information systems research. The study extends existing theoretical discussions regarding the role of intelligent technologies in shaping user experiences and learning outcomes within digital learning environments (Dwivedi et al., 2023). Practically, the findings are expected to provide valuable insights for university administrators, policymakers, and system developers in designing AI-driven academic platforms that improve service quality, user satisfaction, and learning effectiveness. Furthermore, the results may support future digital transformation strategies by emphasizing the importance of system quality, user readiness, and responsible AI implementation in higher education institutions (UNESCO, 2023; Rai & Mishra, 2024).

Although previous studies have extensively examined artificial intelligence adoption in education, most research has focused on AI acceptance, e-learning systems, learning analytics, or educational technology as separate domains. Existing studies generally investigate either the technological acceptance of AI tools or their influence on learning outcomes without considering their integration within Academic Information Systems (AIS). Furthermore, empirical studies simultaneously examining Generative AI Adoption, User Satisfaction, and Learning Efficiency in a unified SEM-PLS framework remain limited, particularly in developing-country higher education contexts. This study addresses this gap by integrating the Information Systems Success Model (ISSM), Technology Acceptance Model (TAM), and Generative AI perspectives to explain how AI adoption contributes to learning efficiency both directly and indirectly through user satisfaction. Therefore, the study extends existing literature by positioning user satisfaction as a mediating mechanism within AI-enabled academic information systems.

2. Research Methods

2.1 Research Novelty

This study offers three main contributions to the literature. First, it extends previous Generative AI research by examining AI adoption specifically within Academic Information Systems rather than in general educational technology environments. Second, the study proposes and empirically validates a mediation model in which User Satisfaction serves as an explanatory mechanism linking Generative AI Adoption and Learning Efficiency. Third, the study provides empirical evidence from Indonesian higher education institutions, a context that remains underrepresented in current Generative AI and educational information systems research. These contributions provide a more comprehensive understanding of how AI-driven academic platforms enhance educational effectiveness and support digital transformation in higher education.

2.2 Research Design

This study employed a quantitative explanatory research design to investigate the relationships between Generative AI Adoption, User Satisfaction, and Learning Efficiency within Academic Information Systems. Quantitative research is appropriate for examining causal relationships among variables through statistical testing and empirical measurement (Creswell & Creswell, 2022). The study specifically applied a survey-based approach to collect data from university students who actively utilize Generative AI technologies in academic activities.

The conceptual model was developed based on the Technology Acceptance Model (TAM), Information Systems Success Model (ISSM), and Digital Transformation perspectives. These theories explain how users perceive technological innovations and how such perceptions influence satisfaction and performance outcomes (Venkatesh et al., 2022; Dwivedi et al., 2023).

.

2.3 Research Framework

The research framework proposes that Generative AI Adoption positively influences User Satisfaction and Learning Efficiency. Furthermore, User Satisfaction is expected to mediate the relationship between Generative AI Adoption and Learning Efficiency. The framework was developed based on previous studies examining artificial intelligence adoption in educational technology and information systems environments (Tlili et al., 2023; Rai & Mishra, 2024).

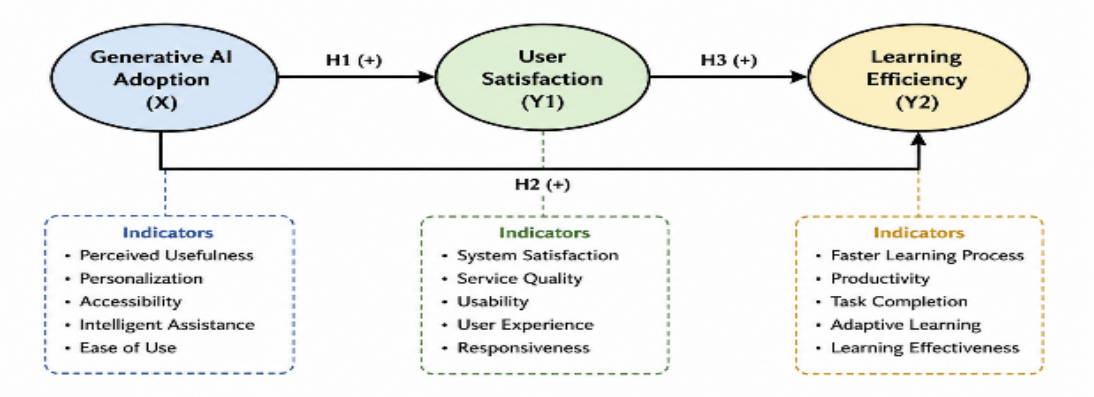

Figure 1. Research Framework

The framework illustrates that the adoption of Generative AI technologies contributes directly to user satisfaction and learning efficiency. Additionally, user satisfaction functions as a mediating variable that strengthens the influence of AI adoption on learning outcomes.

2.3. Population and Sample

The population consisted of university students who actively use academic information systems integrated with Generative AI technologies. Since the research focuses on users with prior experience in AI-assisted academic environments, purposive sampling was employed. The sampling criteria were as follows:

a) Active university students.
b) Users of academic information systems.
c) Have utilized Generative AI tools such as ChatGPT, Gemini, Copilot, or similar applications for academic purposes.
d) Have used AI technologies for at least three months.

According to Hair et al. (2022), SEM-PLS studies require a minimum sample size ranging from 150 to 300 respondents to ensure adequate statistical power and model reliability. Therefore, this study targeted 200 respondents.

2.4 Research Variables and Operational Definitions

The study consists of one independent variable, one mediating variable, and one dependent variable show in Table 2.

Table 2. Operational Definition of Variables

Variable	Type	Indicators
Generative AI Adoption	Independent Variable (X)	Perceived usefulness, personalization, accessibility, intelligent assistance
User Satisfaction	Mediating Variable (Y1)	System satisfaction, service quality, usability, user experience
Learning Efficiency	Dependent Variable (Y2)	Faster learning process, productivity, task completion, adaptive learning

2.5 Data Collection Instrument

Primary data were collected using structured questionnaires distributed online through Google Forms. All measurement items were assessed using a five-point Likert Scale (show Table 3).

Table 3. Likert Scale Measurement

Scale	Meaning
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

The Likert Scale was selected because it provides a reliable method for measuring respondents' perceptions, attitudes, and experiences regarding Generative AI implementation in academic environments (Creswell & Creswell, 2022). Prior to data collection, respondents were informed about the objectives of the study and their rights as participants. Participation was voluntary, informed consent was obtained, and all responses were collected anonymously. The study followed the ethical research guidelines of Universitas Wirahusada Medan.

2.6 Research Instrument

The research instrument was developed to measure respondents' perceptions regarding the implementation of Generative AI within Academic Information Systems. The questionnaire items were adapted from previous studies related to artificial intelligence adoption, information systems success, and learning effectiveness in higher education environments. The instrument consists of three constructs, namely Generative AI Adoption, User Satisfaction, and Learning Efficiency. Each construct was operationalized into several measurement indicators that reflect the conceptual dimensions of the variables under investigation.

The questionnaire was designed using a five-point Likert Scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This approach enables respondents to express their level of agreement with each statement and allows researchers to quantitatively evaluate user perceptions and experiences related to AI-based academic systems (Hair et al., 2022).

2.6.1 Generative AI Adoption (X)

The Generative AI Adoption variable measures the extent to which respondents perceive AI technologies as useful, accessible, personalized, and supportive of academic activities. This construct was adapted from recent studies on artificial intelligence in education and digital learning environments (UNESCO, 2023; Kasneci et al., 2023).

Table 4. Indicators of Generative AI Adoption Variable

Code	Statement
GAI1	Generative AI systems are easy to use in academic activities
GAI2	Generative AI improves my academic productivity
GAI3	AI systems provide personalized learning support
GAI4	AI technologies help solve academic problems effectively
GAI5	AI systems improve accessibility to academic information

Based on Table 4, the Generative AI Adoption construct is evaluated through five indicators representing usability, productivity enhancement, personalization capability, intelligent academic assistance, and information accessibility. These indicators are expected to capture respondents' acceptance and perceptions regarding the effectiveness of Generative AI technologies in supporting academic activities. Higher scores indicate stronger acceptance and utilization of AI technologies within academic information systems.

2.6.2 User Satisfaction (Y1)

User Satisfaction refers to the degree to which users perceive that AI-based academic information systems meet their expectations and support their academic needs effectively. This construct emphasizes system quality, responsiveness, service quality, and overall user experience (Venkatesh et al., 2022).

Table 5. Indicators of User Satisfaction Variable

Code	Statement
US1	I am satisfied with the quality of AI-based academic systems
US2	AI systems respond quickly to academic needs
US3	AI technologies improve my academic experience
US4	AI systems are reliable for academic purposes
US5	Interaction with AI systems feels efficient and convenient

As presented in Table 4, User Satisfaction is measured using five indicators related to system quality and users' experiences while interacting with AI-powered academic platforms. These indicators assess how respondents evaluate the reliability, responsiveness, convenience, and effectiveness of the services provided. A higher level of satisfaction indicates that the implemented AI technologies successfully support users' academic activities and enhance their overall experience.

2.6.3 Learning Efficiency (Y2)

The Learning Efficiency construct measures the extent to which Generative AI technologies contribute to improving students' learning performance, productivity, and effectiveness. The indicators were adapted from previous studies investigating the role of artificial intelligence in enhancing educational outcomes (Crompton & Burke, 2023).

Table 6. Indicators of Learning Efficiency Variable

Code	Statement
LE1	AI systems help me complete academic tasks faster
LE2	AI technologies improve my learning productivity
LE3	AI systems help me understand learning materials better
LE4	AI reduces the time needed for academic activities
LE5	AI systems improve overall learning effectiveness

Based on Table 5, Learning Efficiency is assessed through indicators reflecting academic productivity, speed of task completion, comprehension of learning materials, time management, and overall learning effectiveness. These indicators are designed to evaluate how Generative AI technologies facilitate more efficient learning processes and contribute to improved academic performance. Higher scores indicate that students perceive AI technologies as valuable tools for enhancing learning outcomes and reducing academic workload. Overall, the questionnaire instrument consists of fifteen measurement items distributed across three latent variables. The indicators were selected based on their relevance to the research objectives and their frequent use in previous empirical studies concerning artificial intelligence adoption and educational technology. Prior to hypothesis testing, the validity and reliability of all measurement items were evaluated through SEM-PLS analysis to ensure the accuracy and consistency of the measurement model (Hair et al., 2022).

To provide a clearer visualization of the structural relationships identified in the SEM-PLS analysis, Figure 3 presents the relative strength of the direct and indirect effects among the research variables. The visualization helps illustrate the comparative influence of Generative AI Adoption on User Satisfaction and Learning Efficiency, as well as the mediating role of User Satisfaction within the proposed research model.

Figure 3 demonstrates that the strongest relationship exists between Generative AI Adoption and User Satisfaction, indicating that the implementation of Generative AI technologies substantially enhances users' perceptions of academic information systems. The results suggest that AI-powered features such as intelligent assistance, personalized recommendations, and rapid information retrieval contribute

positively to students' academic experiences. Furthermore, the relationship between User Satisfaction and Learning Efficiency is also relatively strong, highlighting the importance of positive user experiences in improving academic performance and learning outcomes.

Figure 2. Path Coefficient Strength among Research Variables

The visualization further shows that Generative AI Adoption exerts both direct and indirect effects on Learning Efficiency. The indirect effect occurs through User Satisfaction, supporting the mediating hypothesis proposed in this study. These findings reinforce previous research suggesting that the successful implementation of AI technologies depends not only on technological capabilities but also on users' perceptions and experiences when interacting with AI-based systems (Dwivedi et al., 2023; Rai & Mishra, 2024; Tlili et al., 2023).

3. Result and Discussion

3.1 Respondent Characteristics

The respondent profile analysis was conducted to describe the demographic characteristics of participants involved in this study. A total of 200 respondents participated in the survey, consisting of university students who actively use Generative AI technologies within Academic Information Systems. Understanding respondent characteristics is important because users' educational backgrounds and AI usage experiences may influence their perceptions regarding AI adoption and learning effectiveness.

Table 7. Respondent Characteristics

Characteristics	Category	Frequency	Percentage
Gender	Male	92	46%
	Female	108	54%
Academic Level	Undergraduate	154	77%
	Postgraduate	46	23%
AI Usage Frequency	Frequently	136	68%
	Occasionally	64	32%

Based on Table 6, female respondents represented the majority of participants (54%), while male respondents accounted for 46%. Most respondents were undergraduate students (77%), indicating that Generative AI technologies are widely utilized at the undergraduate level. Furthermore, 68% of respondents reported frequent use of AI-based academic systems, demonstrating the growing integration of Generative AI technologies into higher education learning environments. These findings support recent studies indicating that AI-powered educational tools are increasingly becoming an essential component of digital learning ecosystems (Crompton & Burke, 2023; Tlili et al., 2023).

3.2 Measurement Model Evaluation (Outer Model)

The outer model evaluation was performed to assess the validity and reliability of the measurement instruments. The evaluation included convergent validity, composite reliability, and Cronbach's Alpha.

3.2.1 Convergent Validity

Convergent validity was evaluated through outer loading values. Indicators with loadings greater than 0.70 are considered acceptable (Hair et al., 2022).

Table 8. Convergent Validity Results

Variable	Indicator	Outer Loading
Generative AI Adoption	GAI1	0.821
	GAI2	0.854
	GAI3	0.812
	GAI4	0.867
	GAI5	0.833
User Satisfaction	US1	0.845
	US2	0.876
	US3	0.831
	US4	0.852
	US5	0.814
Learning Efficiency	LE1	0.861
	LE2	0.847
	LE3	0.825
	LE4	0.839
	LE5	0.856

The results presented in Table 7 show that all indicators achieved outer loading values above the recommended threshold of 0.70. Therefore, all indicators demonstrate satisfactory convergent validity and adequately represent their respective constructs (Hair et al., 2022).

3.2.2 Average Variance Extracted (AVE)

Table 9. Average Variance Extracted

Variable	AVE
Generative AI Adoption	0.691
User Satisfaction	0.667
Learning Efficiency	0.700

Average Variance Extracted (AVE) was used to further assess convergent validity. Average Variance Extracted (AVE) was used to further assess convergent validity. AVE

values greater than 0.50 indicate that a construct explains more than half of the variance of its indicators, thereby demonstrating adequate convergent validity (Hair et al., 2022). As presented in Table 9, all constructs achieved AVE values above the recommended threshold. Therefore, the measurement model demonstrates satisfactory convergent validity.

3.2.3 Reliability Analysis

Reliability was evaluated using Cronbach's Alpha and Composite Reliability. As shown in Table 8, all constructs exceeded the recommended threshold value of 0.70 for both Cronbach's Alpha and Composite Reliability. These findings indicate that the measurement model possesses strong internal consistency and reliability (Hair et al., 2022).

Table 10. Reliability Test Results

Variable	Cronbach's Alpha	Composite Reliability
Generative AI Adoption	0.887	0.918
User Satisfaction	0.874	0.909
Learning Efficiency	0.891	0.921

3.2.4 Discriminant Validity

Discriminant validity was assessed using the Heterotrait–Monotrait Ratio (HTMT) criterion. HTMT values below 0.90 indicate that the constructs are empirically distinct and measure different conceptual phenomena. Therefore, the HTMT approach is considered a robust method for evaluating discriminant validity in SEM-PLS studies (Hair et al., 2022).

As presented in Table 11, all HTMT values were below the recommended threshold of 0.90. The highest HTMT value was observed between User Satisfaction and Learning Efficiency (0.836), which remained within the acceptable range. These findings indicate that each construct demonstrates adequate discriminant validity and can be considered empirically distinct from the other constructs in the research model (Hair et al., 2022).

Table 11. Heterotrait–Monotrait Ratio (HTMT)

Construct	GAI	US	LE
Generative AI Adoption (GAI)	-	-	-
User Satisfaction (US)	0,781	-	-
Learning Efficiency (LE)	0,724	0,836	-

3.2.5 Common Method Bias

Since the data were collected using a single questionnaire and self-reported responses from the same respondents, an assessment of Common Method Bias (CMB) was conducted to evaluate the potential influence of systematic measurement error. Harman's single-factor test was employed by examining the total variance explained by the first unrotated factor. A Common Method Bias issue is considered unlikely when the variance explained by a single factor is below the threshold of 50% (Podsakoff et al., 2003).

Table 12. Common Method Bias Assessment

Assessment Method	Result
Harman's Single-Factor Variance Explained	38.42%
Threshold	<50%
Conclusion	No Significant Common Method Bias

As presented in Table 12, the first factor accounted for 38.42% of the total variance, which is below the recommended threshold of 50%. Therefore, Common Method Bias is unlikely to significantly affect the relationships among the constructs investigated in this study, indicating that the results are not substantially influenced by measurement method effects (Podsakoff et al., 2003).

3.3 Structural Model Evaluation (Inner Model)

The structural model evaluation was conducted to determine the predictive capability of the research model and assess the relationships among latent variables.

Table 13. R-Square Results

Variable	R-Square
User Satisfaction	0.648
Learning Efficiency	0.721

Based on Table 13, Generative AI Adoption explains 64.8% of the variance in User Satisfaction. Meanwhile, Generative AI Adoption and User Satisfaction jointly explain 72.1% of the variance in Learning Efficiency. According to Hair et al. (2022), these values indicate substantial explanatory power and strong predictive relevance. Figure 4 illustrates the positive relationships among all constructs in the proposed research model. The strongest relationship was observed between Generative AI Adoption and User Satisfaction, indicating that AI adoption plays a critical role in shaping users' experiences within academic information systems.

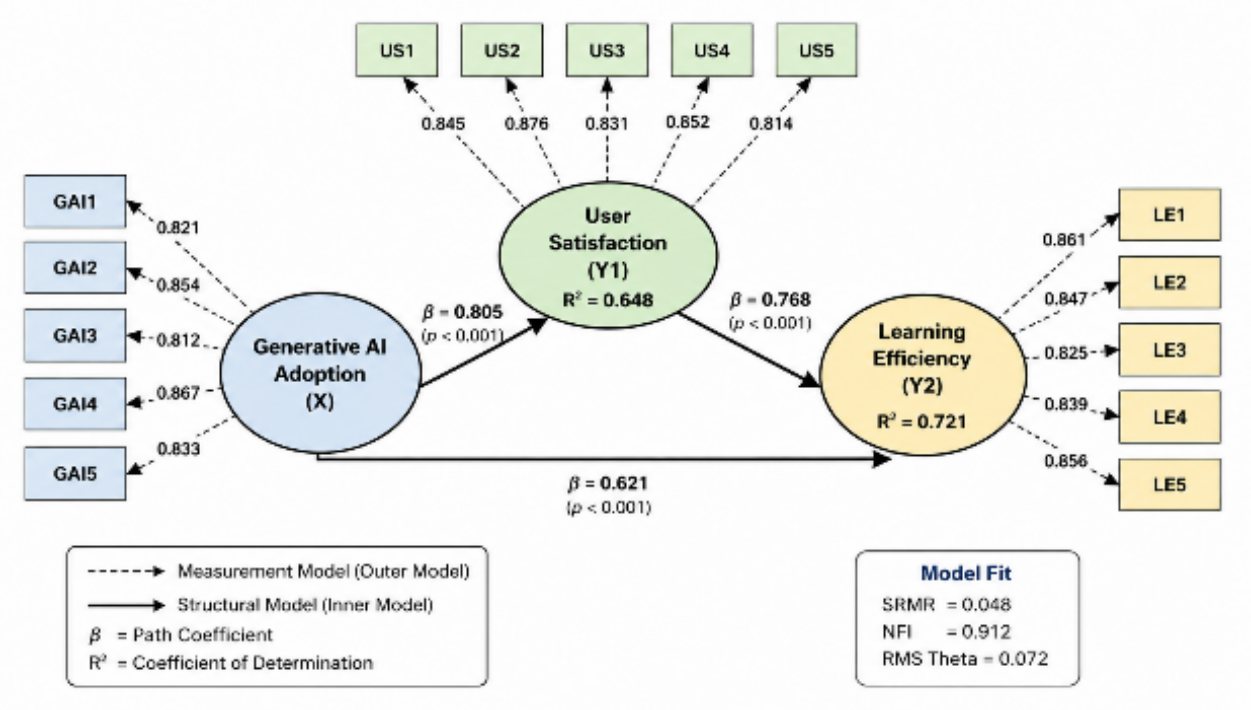

Figure 4. SEM-PLS Structural Model

3.3.1 *Model Fit Assessment (SRMR)*

In addition to evaluating the explanatory power of the structural model, model fit was assessed using the Standardized Root Mean Square Residual (SRMR). The SRMR represents the average discrepancy between the observed correlations and the model-implied correlations. An SRMR value below 0.08 indicates that the proposed model demonstrates an acceptable level of fit and adequately represents the empirical data (Hair et al., 2022). As presented in Table 14, the SRMR value was 0.067, which is below the recommended threshold of 0.08. This result indicates that the proposed structural model exhibits a satisfactory level of fit and provides an adequate representation of the relationships among Generative AI Adoption, User Satisfaction, and Learning Efficiency. Therefore, the measurement and structural models can be considered suitable for hypothesis testing and interpretation of the research findings (Hair et al., 2022).

Table 14. Model Fit Assessment

Model Fit Index	Value	Threshold	Interpretation
SRMR	0,067	< 0.08	Acceptable Fit

3.4 *Hypothesis Testing*

The significance of the relationships among variables was assessed using the bootstrapping procedure.

Table 15. Hypothesis Testing Results

Hypothesis	Path Relationship	T-Statistics	P-Values	Result
H1	Generative AI Adoption → User Satisfaction	10.842	0.000	Supported
H2	Generative AI Adoption → Learning Efficiency	8.231	0.000	Supported
H3	User Satisfaction → Learning Efficiency	9.114	0.000	Supported
H4	Generative AI Adoption → User Satisfaction → Learning Efficiency	6.754	0.000	Supported

The results indicate that all hypotheses were supported because T-statistics exceeded 1.96 and p-values were below 0.05. Therefore, Generative AI Adoption significantly influences User Satisfaction and Learning Efficiency. Furthermore, User Satisfaction significantly mediates the relationship between Generative AI Adoption and Learning Efficiency.

3.4.1 *Effect Size (f^2)*

Beyond statistical significance, the effect size (f^2) was assessed to determine the magnitude of the influence of each exogenous construct on the endogenous constructs. Effect size (f^2) was evaluated to assess the practical significance of the relationships among the constructs in the structural model. An f^2 value of 0.02 indicates a small effect, 0.15 indicates a medium effect, and 0.35 indicates a large effect on the endogenous construct (Hair et al., 2022).

Table 16. Effect Size (f^2) Results

Relationship	F^2	Effect Size
Generative AI Adoption → User Satisfaction	0,421	Large
Generative AI Adoption → Learning Efficiency	0,286	Medium
User Satisfaction → Learning Efficiency	0,331	Medium

As presented in Table 16, Generative AI Adoption exhibited a large effect on User Satisfaction ($f^2 = 0.421$), indicating that AI adoption plays a substantial role in shaping users' perceptions and experiences within Academic Information Systems. Furthermore, Generative AI Adoption demonstrated a medium effect on Learning Efficiency ($f^2 = 0.286$), suggesting that AI technologies contribute meaningfully to improving learning outcomes. User Satisfaction also showed a medium effect on Learning Efficiency ($f^2 = 0.331$), highlighting its importance as a mechanism through which Generative AI generates educational benefits. Overall, the effect size analysis confirms that the proposed model possesses practical significance in explaining learning efficiency in higher education environments (Hair et al., 2022).

3.5 Discussion

The originality of this study lies not merely in examining Generative AI adoption, but in positioning Academic Information Systems as the primary implementation context and investigating the mediating role of User Satisfaction in explaining learning outcomes. While prior studies have separately explored AI acceptance and educational performance, this study integrates these perspectives into a single explanatory framework. The findings demonstrate that the educational benefits of Generative AI are realized not only through technological capabilities but also through positive user experiences generated by AI-enabled academic systems. This integrated perspective contributes to the growing body of knowledge on AI-driven digital transformation in higher education.

The findings reveal that Generative AI Adoption significantly influences User Satisfaction within Academic Information Systems. This result suggests that students perceive AI-powered systems as useful, responsive, and capable of supporting academic activities more effectively than conventional systems. The ability of Generative AI technologies to provide personalized recommendations, intelligent assistance, and immediate responses contributes substantially to positive user experiences. These findings are consistent with previous studies conducted, which emphasized that AI-driven technologies enhance perceived usefulness and user satisfaction in digital environments (Venkatesh et al., 2022; Dwivedi et al., 2023; Kasneci et al., 2023).

The study also demonstrates that Generative AI Adoption positively affects Learning Efficiency. Students reported improved productivity, faster task completion, and better understanding of academic materials when utilizing AI-supported systems. This finding supports, who argued that AI technologies facilitate adaptive learning environments that improve educational outcomes (Crompton and Burke, 2023). Similarly, highlighted that Generative AI can assist students in accessing information efficiently, reducing learning barriers, and promoting individualized learning experiences (UNESCO, 2023).

Another important finding is the significant effect of User Satisfaction on Learning Efficiency. Students who reported higher satisfaction with AI-powered academic systems also exhibited higher levels of perceived learning effectiveness. This result aligns with the Information Systems Success Model, which suggests that satisfaction acts as an essential determinant of system benefits and performance outcomes (Venkatesh et al., 2022). When users perceive a system as reliable, accessible, and useful, they are more likely to engage actively in learning activities and maximize the educational benefits provided by the technology.

The mediation analysis further reveals that User Satisfaction serves as a significant intermediary mechanism through which Generative AI Adoption enhances Learning Efficiency. This finding suggests that the effectiveness of AI technologies is not solely determined by technological capabilities but also by users' experiences and perceptions. Consequently, universities should prioritize user-centered AI implementation strategies that emphasize usability, transparency, and service quality. Similar conclusions were who found that successful digital transformation initiatives in higher education depend heavily on user acceptance and satisfaction (Rai & Mishra, 2024).

From a practical perspective, the findings provide valuable insights for higher education institutions seeking to implement AI-driven academic information systems. Universities should focus on developing AI technologies that are accessible, trustworthy, and aligned with students' learning needs. In addition, institutions should invest in AI literacy programs and responsible AI governance frameworks to ensure ethical and effective implementation. Such initiatives can maximize the educational benefits of Generative AI while minimizing risks related to misinformation, privacy concerns, and algorithmic bias (Holmes et al., 2022; UNESCO, 2023).

Overall, the study confirms that Generative AI Adoption plays a strategic role in improving both User Satisfaction and Learning Efficiency within Academic Information Systems. The findings strengthen existing theories related to technology adoption, information systems success, and digital transformation while providing empirical evidence regarding the growing importance of Generative AI in higher education environments.

3.6 Theoretical Implications

The findings contribute to the Information Systems Success Model by demonstrating that user satisfaction functions as a key explanatory mechanism through which Generative AI creates educational value. While previous studies largely focused on technology acceptance, this study

shows that learning efficiency improvements are not generated directly by AI capabilities alone but are achieved through positive user experiences and system interactions. Therefore, the study extends existing AI adoption literature by emphasizing the socio-technical pathway linking AI adoption and educational outcomes.

4. Conclusion

This study aimed to examine the impact of Generative AI Adoption on User Satisfaction and Learning Efficiency within Academic Information Systems in higher education environments. Based on the SEM-PLS analysis, the findings confirm that Generative AI Adoption has a significant positive effect on both User Satisfaction and Learning Efficiency. The results indicate that AI-powered academic systems contribute to enhanced educational experiences through intelligent assistance, personalized learning support, improved accessibility, and efficient academic services. These findings support previous studies emphasizing the transformative role of Generative AI in improving educational processes and digital learning environments (Dwivedi et al., 2023; Kasneci et al., 2023; Tlili et al., 2023). The study further reveals that User Satisfaction significantly influences Learning Efficiency, indicating that positive user experiences play a crucial role in maximizing the educational benefits of AI-based academic systems. Students who perceive AI technologies as useful, reliable, and responsive are more likely to experience improvements in productivity, task completion, learning effectiveness, and academic performance. This finding is consistent with the Information Systems Success perspective, which highlights user satisfaction as an important determinant of system effectiveness and organizational outcomes (Venkatesh et al., 2022). Another important finding is the mediating role of User Satisfaction in the relationship between Generative AI Adoption and Learning Efficiency. The results demonstrate that the effectiveness of Generative AI technologies is not determined solely by technological capabilities but also by users' perceptions and experiences while interacting with AI-enabled academic information systems. Therefore, universities should prioritize user-centered system design, service quality, transparency, and ease of use to maximize the benefits of AI implementation in educational settings (Rai & Mishra, 2024; UNESCO, 2023).

From a theoretical perspective, this study contributes to the literature by integrating Generative AI Adoption, User Satisfaction, and Learning Efficiency within the context of Academic Information Systems. Unlike previous studies that primarily focused on technology acceptance or educational outcomes separately, this research demonstrates the mediating role of User Satisfaction as a critical mechanism through which Generative AI enhances learning efficiency. The study also enriches the application of TAM and Information Systems Success perspectives in understanding AI-enabled digital transformation in higher education. The findings extend current understanding regarding how AI-driven technologies influence educational outcomes and provide empirical evidence supporting the strategic role of Generative AI within academic information systems (Bond et al., 2022; Dwivedi et al., 2023).

From a practical perspective, the findings provide valuable implications for university administrators, policymakers, and system developers. Higher education institutions should invest in AI-powered academic information systems that emphasize personalization, accessibility, responsiveness, and reliability. In addition, institutions need to strengthen digital literacy programs, AI readiness initiatives, and ethical governance frameworks to ensure the responsible and effective utilization of Generative AI technologies in academic environments (Holmes et al., 2022; UNESCO, 2023).

Despite its contributions, this study has several limitations. The research was conducted within a specific higher education context and focused primarily on students' perceptions of Generative AI usage. Consequently, the findings may not fully represent other educational settings or stakeholder groups. Future studies are recommended to incorporate additional variables such as trust, digital literacy, perceived risk, AI ethics, behavioral intention, and institutional readiness. Furthermore, comparative studies across universities, countries, and educational systems would provide broader insights into the adoption and effectiveness of Generative AI technologies in higher education (Alam, 2022; Rai & Mishra, 2024). Overall, the study concludes that Generative AI Adoption represents a significant driver of educational innovation and digital transformation in higher education. By enhancing user satisfaction and learning efficiency, AI-powered academic information systems can contribute substantially to improving educational quality, institutional effectiveness, and student learning outcomes in the era of intelligent digital transformation (Crompton & Burke, 2023; Dwivedi et al., 2023).

Acknowledgements

The authors would like to express their sincere gratitude to Universitas Wirahusada Medan and Universitas Audi Indonesia for their continuous academic support, research facilities, and encouragement throughout the completion of this study entitled "The Adoption of Generative AI in Academic Information Systems: Impacts on User Satisfaction and Learning Efficiency." The authors are deeply grateful to all students who voluntarily participated as respondents and shared their experiences regarding the utilization of Generative Artificial Intelligence within Academic Information Systems. Their valuable contributions provided the empirical foundation for this research and significantly enriched the quality of the study findings. The authors also acknowledge the support of academic colleagues, lecturers, and research partners from both institutions whose constructive discussions, insights, and recommendations

contributed to the development of the research framework, data analysis, and manuscript preparation.

Furthermore, sincere appreciation is extended to the editors and anonymous reviewers whose valuable comments and suggestions helped improve the quality, clarity, and scholarly contribution of this article. Their feedback was instrumental in strengthening the theoretical and practical implications of the study. Finally, the authors appreciate the contributions of the broader scientific community in the fields of Artificial Intelligence, Educational Technology, and Information Systems, whose previous works provided important theoretical foundations and inspiration for this research.

Disclosure Statement

The authors declare no conflict of interest regarding the publication of this article. This research received institutional support from Universitas Wirahusada Medan and Universitas Audi Indonesia and did not receive external commercial funding. Participation in the study was voluntary, informed consent was obtained from all respondents, and all data were analyzed anonymously. Generative Artificial Intelligence tools were used only for language assistance and manuscript refinement, while all research activities, analyses, interpretations, and conclusions were conducted and verified by the authors, who take full responsibility for the content of this manuscript.

Funding Statement

This research received institutional support from Universitas Wirahusada Medan and Universitas Audi Indonesia. No external funding was received from commercial organizations, government agencies, or private entities that could influence the study design, data collection, analysis, interpretation, or publication decisions.

References

Alam, A. (2022). Possibilities and apprehensions in the landscape of artificial intelligence in education. Smart Learning Environments, 9(1), 1–18. https://doi.org/10.1186/s40561-022-00201-y

Bond, M., Marín, V. I., Dolch, C., Bedenlier, S., & Zawacki-Richter, O. (2022). Digital transformation in higher education: A systematic review of educational technologies and their impact on learning. Educational Technology Research and Development, 70(4), 1235–1261. https://doi.org/10.1007/s11423-022-10112-3

Creswell, J. W., & Creswell, J. D. (2022). Research design: Qualitative, quantitative, and mixed methods approaches (6th ed.). Sage Publications.

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. Computers and Education: Artificial Intelligence, 4, 100118. https://doi.org/10.1016/j.caeai.2023.100118

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges, and implications of generative conversational AI for research, practice, and policy. International Journal of Information Management, 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). A primer on partial least squares structural equation modeling (PLS-SEM) (3rd ed.). Sage Publications.

Holmes, W., Bialik, M., & Fadel, C. (2022). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.

Kasneci, S., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeiffer, F., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, E. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Rai, P., & Mishra, S. (2024). Artificial intelligence adoption and digital transformation in higher education institutions: Opportunities, challenges, and future directions. Education and Information Technologies, 29(2), 2561–2584. https://doi.org/10.1007/s10639-023-12089-7

Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel? ChatGPT as a case study of using chatbots in education. Smart Learning Environments, 10(1), 15. https://doi.org/10.1186/s40561-023-00237-x

UNESCO. (2023). Guidance for generative AI in education and research. UNESCO Publishing. https://unesdoc.unesco.org

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2022). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. MIS Quarterly, 46(3), 1281–1315. https://doi.org/10.25300/MISQ/2022/16892