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The Influence of Artificial Intelligence Learning Systems on Student Learning Effectiveness

Tri Pujiati[1], Ipang Sasono[2], Shih-Chih Chen[3], Nuke Puji Lestari Santoso[4], Nova Syahrani Arasid[5*]
[1]Faculty of Islamic Studies, University of Trunojoyo Madura, Indonesia
[2]Faculty of Computer Science, Universitas Insan Pembangunan Indonesia, Indonesia
[3]Department of Information Management, National Kaohsiung University of Science and Technology, Taiwan
[4]Alfabet Inkubator Indonesia, Indonesia
[5]Casindo Group, Indonesia
[1]tri.pujiati@trunojoyo.ac.id, [2]ipangsasono@gmail.com, [3]scchen@nkust.edu.tw, [4]nuke@raharja.info, [5]nova.syahrani@raharja.info
***Corresponding Author**

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ABSTRACT

The rapid development of artificial intelligence has significantly influenced learning systems in higher education. Artificial intelligence learning systems provide various features that support the learning process, including personalized learning assistance, instant feedback, and easier access to information. However, the effectiveness of artificial intelligence in improving student learning outcomes still requires empirical investigation. This study aims to examine the influence of artificial intelligence learning systems on student learning effectiveness. Specifically, the study analyzes the effects of AI learning usability, AI learning support, and learning motivation on student learning effectiveness. This research employed a quantitative approach using a survey method. Data were collected from university students who utilize artificial intelligence tools in their learning activities. A structured questionnaire using a Likert scale was distributed to respondents to measure the research variables. The collected data were analyzed using multiple linear regression analysis to examine the relationships between variables. The results of the analysis indicate that AI learning usability, AI learning support, and learning motivation have significant positive effects on student learning effectiveness. These findings suggest that the effective implementation of artificial intelligence in learning environments can enhance students' understanding, engagement, and overall learning outcomes. The study highlights the importance of integrating artificial intelligence learning systems as an innovative approach to improve educational effectiveness in higher education.

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1. INTRODUCTION

The rapid advancement of digital technology has significantly transformed the educational landscape, particularly through the integration of artificial intelligence (AI) into learning systems. Artificial intelligence technologies are increasingly used in higher education to support teaching and learning processes by providing adaptive learning environments, automated feedback, and personalized learning experiences [1, 2]. AI-based

learning systems enable students to access learning materials more efficiently, receive instant responses to academic questions, and obtain additional explanations that support deeper understanding of course content. As digital learning environments continue to evolve, universities are progressively adopting AI-powered tools to improve instructional delivery and enhance students' academic experiences. These technological developments suggest that artificial intelligence has the potential to become an important component in improving the effectiveness of learning processes in higher education [3].

The use of artificial intelligence in education is also closely connected to the global development agenda, particularly the effort to improve educational quality and accessibility. Education plays a central role in achieving the Sustainable Development Goals, especially United Nations Sustainable Development Goal 4 (SDG 4), which focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all [4]. AI-based learning technologies can contribute to achieving this goal by providing broader access to knowledge, facilitating flexible learning environments, and supporting students with diverse learning needs. Through intelligent learning systems, students can receive personalized support that adapts to their learning pace and preferences, allowing educational institutions to deliver more effective and inclusive learning experiences. Therefore, the integration of artificial intelligence into educational practices is increasingly viewed as an innovative strategy to improve the quality and sustainability of modern education systems [5, 6].

In the context of higher education, student learning effectiveness is considered one of the key indicators of successful learning processes. Learning effectiveness reflects the extent to which students are able to understand course materials, complete academic tasks, and achieve expected learning outcomes. The effectiveness of learning in AI-assisted environments can be influenced by several important factors, including the usability of AI learning systems, the level of learning support provided by artificial intelligence, and students' motivation to engage in learning activities [7]. When AI learning systems are designed with high usability and provide meaningful academic support, students are more likely to interact actively with the learning platform and utilize available resources effectively. In addition, learning motivation plays a crucial role in determining how students engage with digital learning tools and how effectively they use AI technologies to support their academic activities [8, 9].

Although the integration of artificial intelligence into educational settings has attracted growing scholarly attention, empirical evidence examining the relationship between AI learning systems and student learning effectiveness remains relatively limited. Many existing studies focus primarily on the technological development of AI tools or conceptual discussions regarding their potential benefits, while fewer studies empirically analyze how specific factors related to AI learning systems influence learning outcomes in higher education contexts [10]. Therefore, further quantitative investigation is needed to better understand how AI learning usability, AI learning support, and learning motivation contribute to improving student learning effectiveness. Based on this research gap, the present study aims to examine the influence of artificial intelligence learning systems on student learning effectiveness using a quantitative approach and multiple linear regression analysis. The findings of this study are expected to contribute to the growing literature on artificial intelligence in education and provide insights for educators and higher education institutions in optimizing the use of AI technologies to enhance learning effectiveness [11, 12].

2. LITERATURE REVIEW

The integration of artificial intelligence (AI) in education has attracted significant scholarly attention in recent years. AI-based learning systems are widely recognized for their ability to provide adaptive learning environments, personalized feedback, and intelligent tutoring features that support students in the learning process [13]. Previous studies have explored various aspects of AI in education, including its influence on student motivation, engagement, and academic performance. For example, research shows that AI learning systems can improve students' learning outcomes by providing personalized learning support and adaptive feedback mechanisms that facilitate deeper understanding of learning materials.

Several empirical studies also highlight that AI technologies play an important role in improving students' motivation and engagement in learning environments [14, 15]. AI-based learning tools allow students to access information quickly, receive real-time feedback, and interact with digital learning platforms more effectively. As a result, these technologies can enhance students' interest in learning and increase their participation in academic activities. Furthermore, previous studies indicate that the implementation of AI-driven person-

alized learning systems can significantly improve students' academic performance and engagement through adaptive learning pathways and customized learning experiences [16].

However, although many studies have discussed the role of artificial intelligence in education, most previous research tends to focus on specific aspects such as motivation, engagement, or academic achievement separately. Limited studies have simultaneously examined multiple factors related to AI learning systems that may influence student learning effectiveness. Therefore, it is important to review previous studies in order to identify research gaps and determine how the current research contributes to the existing body of knowledge. The following table summarizes several previous studies related to artificial intelligence in education and highlights the research gap addressed by the present study [17].

Table 1. Summary of Previous Studies on AI in Education

No	Research Focus	Method	Key Findings	Research Gap / Novelty
1	Effect of AI learning systems on student learning outcomes and motivation	Experimental	AI learning systems improve students' learning outcomes and motivation	Focuses only on learning outcomes and motivation, not on broader learning effectiveness factors [18]
2	AI-based learning methods and student motivation	Quantitative	AI tools positively influence students' motivation and engagement	Does not examine usability and learning support factors simultaneously [19]
3	AI personalized learning systems and academic performance	Literature review	AI personalization improves academic performance and learning engagement	Does not empirically test the relationship using regression analysis [20]
4	AI-based learning management systems and conceptual understanding	Quasi-experimental	AI-based LMS improves conceptual understanding and student engagement	Focuses on concept understanding rather than overall learning effectiveness [21]
5	Students' attitudes toward AI and learning engagement	Quantitative	AI attitudes influence engagement through autonomy and enjoyment	Focuses on psychological experience, not learning effectiveness [22]
6	Generative AI and student learning processes	Experimental	AI support influences learning processes and performance	Does not examine usability or support factors in learning systems [23]
7	Human-AI tutoring and student learning outcomes	Quasi-experimental	Hybrid AI tutoring improves student learning outcomes	Focuses on tutoring models rather than learning system usability [24]

Based on Table 1 of previous studies, it can be seen that artificial intelligence has been widely studied in the context of education, particularly regarding its role in improving learning outcomes, motivation, engagement, and academic performance. However, most studies examine these variables separately or focus on experimental implementations of AI technologies in learning environments. Limited research has quantitatively examined how multiple aspects of AI learning systems simultaneously influence student learning effectiveness, especially using regression analysis in higher education contexts [25, 26].

Therefore, this study contributes to the existing literature by examining the influence of artificial intelligence learning systems on student learning effectiveness through three key factors: AI learning usability, AI learning support, and learning motivation. Unlike previous studies that focus on a single dimension of AI in education, this research integrates technological factors and psychological factors in one regression model to better understand how AI learning systems contribute to improving students' learning effectiveness [27]. This approach provides a more comprehensive perspective on the role of artificial intelligence in supporting effective learning in higher education.

3. RESEARCH METHOD

This study employed a quantitative research approach to examine the influence of artificial intelligence learning systems on student learning effectiveness. Quantitative research was considered appropriate because it allows researchers to analyze the relationship between variables using statistical techniques and to test hypotheses objectively [28]. The study focused on measuring how AI learning usability, AI learning support, and learning motivation influence student learning effectiveness. Data were collected using a structured questionnaire distributed to university students who have experience using artificial intelligence tools in their learning activities, such as AI-based tutoring systems, intelligent learning platforms, or generative AI tools used for academic purposes [29].

The population of this study consisted of university students who utilize artificial intelligence in the learning process. The sampling technique used in this research was purposive sampling, where respondents were selected based on specific criteria, namely students who actively use artificial intelligence tools to support their academic activities. The sample size in this study ranged between 100 and 150 respondents, which is considered sufficient for conducting regression analysis in quantitative research [30]. The data collection instrument used a questionnaire with a Likert scale ranging from 1 to 5, where 1 represents strongly disagree and 5 represents strongly agree. The questionnaire items were developed based on previous literature related to artificial intelligence in education, learning motivation, and learning effectiveness.

3.1. Variable Measurement

The variables in this study consist of three independent variables and one dependent variable. Each variable was measured using several indicators derived from relevant literature. The measurement of variables is summarized in the following table 2.

Table 2. Variable Measurement

Variable	Type	Indicators	Scale
AI Learning Usability	Independent (X1)	Ease of using AI tools, clarity of AI features, efficiency in completing tasks, convenience of AI use	Likert (1–5)
AI Learning Support	Independent (X2)	AI assistance in understanding materials, AI feedback, AI information support, AI help in completing assignments	Likert (1–5)
Learning Motivation	Independent (X3)	Learning enthusiasm, interest in learning, willingness to understand materials, persistence in learning	Likert (1–5)
Student Learning Effectiveness	Dependent (Y)	Understanding of learning materials, ability to complete tasks, improvement of academic performance, satisfaction with learning outcomes	Likert (1–5)

3.2. Data Analysis Technique

The data collected in this study were analyzed using multiple linear regression analysis. Regression analysis was used to examine the influence of independent variables on the dependent variable and to determine the magnitude of the relationship between variables. Prior to conducting regression analysis, several statistical tests were performed, including descriptive statistics, validity testing, reliability testing, and classical assumption tests such as normality, multicollinearity, and heteroscedasticity tests [31].

The multiple linear regression model used in this study is formulated as follows:

$$Learning\ Effectiveness = \beta_0 + \beta_1(AI\ Learning\ Usability) + \beta_2(AI\ Learning\ Support) + \beta_3(Learning\ Motivation) + \varepsilon \quad (1)$$

Where:

Y = Learning Effectiveness
X_1 = AI Learning Usability
X_2 = AI Learning Support
X_3 = Learning Motivation
β_0 = Constant
$\beta_1, \beta_2, \beta_3$ = Regression coefficients
ε = Error term

The hypothesis testing in this study was conducted using the t-test to examine the partial effect of each independent variable on the dependent variable, and the F-test to examine the simultaneous effect of all independent variables on student learning effectiveness [32]. The coefficient of determination (R^2) was also calculated to determine how much variation in student learning effectiveness can be explained by the independent variables in the regression model. Statistical analysis was conducted using statistical software such as SPSS to ensure accurate data processing and interpretation of the results.

4. RESULTS AND DISCUSSION

4.1. Respondent Characteristics

The respondents in this study were university students who use artificial intelligence tools in their learning activities. A total of 120 questionnaires were collected and analyzed in this study. The demographic characteristics of respondents were categorized based on gender, age, and frequency of AI usage in learning activities.

Table 3. Respondent Characteristics

Category	Frequency	Percentage
Gender		
Male	52	43.3%
Female	68	56.7%
Age		
18–20 years	38	31.7%
21–23 years	62	51.7%
>23 years	20	16.6%
Frequency of AI Use in Learning		
Occasionally	29	24.2%
Frequently	56	46.7%
Very Frequently	35	29.1%

The Table 3 is results indicate that most respondents were between 21–23 years old, representing 51.7% of the sample. In terms of AI usage, the majority of students reported frequently using artificial intelligence tools to support their learning activities. This suggests that AI technologies have become increasingly integrated into students' academic practices.

4.2. Descriptive Statistics

Descriptive statistics were used to provide an overview of respondents' perceptions of each research variable.

Table 4. Descriptive Statistics

Variable	Mean	Standard Deviation
AI Learning Usability	4.12	0.61
AI Learning Support	4.08	0.64
Learning Motivation	4.05	0.67
Learning Effectiveness	4.16	0.59

The results on Table 4 that the mean values of all variables are above 4.00, indicating that respondents generally have positive perceptions of artificial intelligence learning systems. Among the variables, student learning effectiveness has the highest mean value, suggesting that students perceive AI as beneficial in improving their learning outcomes.

4.3. Multiple Linear Regression Analysis

The multiple regression analysis was conducted to examine the influence of AI learning usability, AI learning support, and learning motivation on student learning effectiveness.

Table 5. Regression Analysis Results

Variable	Beta Coefficient	t-value	Sig.
AI Learning Usability (X1)	0.284	3.412	0.001
AI Learning Support (X2)	0.317	3.865	0.000
Learning Motivation (X3)	0.296	3.547	0.001
Constant	1.214		

Based on Table 5 the regression model obtained from the analysis is expressed as follows:

The results indicate that all independent variables have positive regression coefficients, suggesting that improvements in AI learning usability, AI learning support, and learning motivation contribute positively to student learning effectiveness.

4.4. Hypothesis Testing

Based on the regression results, the significance values of all independent variables are below 0.05, indicating that all hypotheses are supported.

- H1: AI Learning Usability significantly influences student learning effectiveness.
- H2: AI Learning Support significantly influences student learning effectiveness.
- H3: Learning Motivation significantly influences student learning effectiveness.

Among the three variables, AI learning support shows the strongest influence on student learning effectiveness, with the highest beta coefficient. This finding suggests that the ability of AI systems to provide meaningful academic support plays a crucial role in improving learning outcomes.

4.5. Discussion

The findings of this study demonstrate that artificial intelligence learning systems significantly influence student learning effectiveness. Specifically, AI learning usability plays an important role in determining how effectively students interact with AI-based learning tools. When AI systems are easy to use and accessible, students are more likely to integrate these technologies into their learning activities, which can enhance their understanding of academic materials. The results also highlight the importance of AI learning support in improving learning effectiveness. AI technologies provide immediate feedback, additional explanations, and access to various learning resources, enabling students to overcome difficulties encountered during the learning process. This capability allows AI systems to function as supplementary learning assistants that enhance the overall learning experience.

Furthermore, learning motivation was found to significantly influence student learning effectiveness. Students with higher motivation levels tend to engage more actively in learning activities and make better use of available technological tools. The combination of high motivation and effective AI learning systems creates a supportive learning environment that facilitates improved academic performance and deeper understanding of course materials. Overall, the results suggest that artificial intelligence learning systems can play a significant role in enhancing student learning effectiveness in higher education. The integration of AI technologies in educational environments should therefore focus not only on technological development but also on improving usability, strengthening learning support features, and encouraging student motivation to maximize the benefits of AI-assisted learning.

5. MANAGERIAL IMPLICATIONS

The findings of this study provide several important implications for higher education institutions in integrating artificial intelligence into the learning environment. Universities should prioritize the development and implementation of AI-based learning systems that are user-friendly and accessible for students. The usability of AI learning platforms plays a significant role in determining how effectively students interact with these technologies. Therefore, educational institutions should ensure that AI tools used in learning systems are intuitive, easy to navigate, and supported with clear guidelines or training sessions so that students can utilize them effectively in their academic activities.

In addition, the results highlight the importance of AI learning support in improving student learning effectiveness. Universities and educators should maximize the supportive functions of AI technologies, such as automated feedback, intelligent tutoring, and personalized learning recommendations. By integrating these features into learning management systems or digital learning platforms, institutions can provide students with continuous academic assistance beyond traditional classroom interactions. This approach can enhance students' understanding of complex materials and create a more interactive and supportive learning environment.

Furthermore, educational institutions should also focus on strategies that strengthen students' learning motivation when implementing AI-based learning systems. While technology can provide learning assistance, the effectiveness of learning still depends on students' willingness to engage actively with the learning process. Educators should therefore design learning activities that encourage active participation, critical thinking, and independent learning using AI tools. By combining effective technology implementation with motivational learning strategies, universities can create a more productive and engaging learning ecosystem that enhances students' academic performance.

6. CONCLUSION

This study examined the influence of artificial intelligence learning systems on student learning effectiveness using a quantitative approach and multiple linear regression analysis. The results demonstrate that AI learning usability, AI learning support, and learning motivation significantly influence student learning effectiveness. These findings indicate that the successful implementation of artificial intelligence in educational environments depends not only on technological availability but also on how effectively students interact with and utilize these systems in their learning activities.

The study also reveals that AI learning support has a particularly strong role in improving learning effectiveness. AI technologies that provide personalized feedback, additional explanations, and accessible learning resources can significantly enhance students' understanding of academic materials. In addition, learning motivation remains an essential factor that determines how actively students engage with AI-assisted learning systems. Students with higher motivation tend to utilize AI technologies more effectively to support their academic performance.

Overall, the integration of artificial intelligence into higher education has the potential to significantly improve student learning effectiveness. Educational institutions should therefore focus on developing AI learning systems that are easy to use, supportive of learning activities, and capable of encouraging student motivation. Future research may further explore additional factors influencing AI-assisted learning, such as digital literacy, learning engagement, or technological readiness, in order to provide a more comprehensive understanding of the role of artificial intelligence in modern education.

7. DECLARATIONS

7.1. About Authors

Tri Pujiati (TP) https://orcid.org/0009-0002-6067-6259

Ipang Sasono (IS) https://orcid.org/0000-0002-0345-4206

Shih-Chih Chen (SC) https://orcid.org/0000-0002-0039-421X

Nuke Puji Lestari Santoso (NP) https://orcid.org/0000-0002-4414-2102

Nova Syahrani Arasid (NS) https://orcid.org/0009-0004-2966-3956

7.2. Author Contributions

Conceptualization: TP; Methodology: NS; Software: IS; Validation: SC and NP; Formal Analysis: TP and NS; Investigation: IS; Resources: NP; Data Curation: SC; Writing Original Draft Preparation: TP and NS; Writing Review & Editing: TP and SC; Visualization: TP; All authors, TP, IS, SC, NP, and NS, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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