



The Effect of Artificial Intelligence (AI)-Based Learning Media and Student Creativity on Learning Outcomes in the Economics Education Evaluation Course

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Abstract

The use of Artificial Intelligence (AI) in education has grown rapidly due to its potential to support more adaptive learning experiences. However, its effectiveness in improving students' learning outcomes still requires further investigation, particularly when associated with students' creativity. This study aims to analyze the effects of AI-based learning media and creativity on learning outcomes in the Economic Learning Evaluation course. The study employed a quantitative method with a quasi-experimental approach using a 2x2 factorial design. The population consisted of 90 fifth-semester students in the Economic Education Study Program, with a sample of 60 students selected through cluster random sampling. Data were collected using creativity instruments and learning outcome tests that met validity and reliability requirements. Data analysis was conducted using two-way ANOVA to examine the main effects and interaction effects among the variables. The results indicate that AI-based learning media do not have a significant effect on learning outcomes, whereas creativity has a positive effect. Furthermore, a significant interaction effect was found between learning media and creativity on learning outcomes. These findings suggest that the effectiveness of AI utilization in learning depends on students' creativity as a supporting internal factor. This study contributes to the development of AI-based learning models integrated with student creativity and provides implications for the ethical use of AI without neglecting cognitive development and critical thinking skills.

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INTRODUCTION

The rapid development of information and communication technology has transformed learning paradigms in higher education, particularly through the utilization of Artificial Intelligence (AI) as an adaptive learning technology capable of personalizing learning materials, providing real-time feedback, and analyzing students' learning progress (Darmawati & Nurhafizah, 2024; Plass & Froehlich, 2025; SH & Supriyono, 2023; Zawacki-Richter et al., 2019). AI offers significant potential in education, including personalized learning, data-driven curriculum development, and the provision of interactive and engaging learning experiences (Farhood et al., 2025; Strzelecki et al., 2024). The implementation of AI has become an essential component of 21st-century educational transformation, as it can enhance student engagement and improve the effectiveness of the learning process (Holmes et al., 2019). The integration of this technology is aligned with the objectives of Sustainable Development Goal 4 (SDG 4: Quality Education), which emphasizes improving the quality of learning through educational technology innovation (Holmes et al., 2019;

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United Nations, 2015; UNESCO, 2021, 2023). In the context of this study, the integration of AI-based learning media and student creativity is expected to create a more adaptive, interactive, and student-centered learning environment, thereby contributing to improved learning outcomes as one of the key indicators of quality education highlighted in SDG 4.

The use of AI in higher education not only has the potential to enhance learning experiences but also supports more responsive and relevant instructional practices (Darmawati & Nurhafizah, 2024; Subhan et al., 2025). Virtual assistants can provide immediate feedback to learners' inquiries, while adaptive learning systems analyze learning progress and recommend materials tailored to individual needs (Dinata et al., 2025; Hermanto et al., 2024). Pardosi et al. (2024) reported that AI-based learning can personalize learning experiences, increase student engagement, and improve learning outcomes through real-time learning analytics. This technology supports instructional practices that are more adaptive and responsive to individual learning needs, thereby enhancing the efficiency and effectiveness of the learning process (Gligorea et al., 2023).

Numerous studies have demonstrated that AI can facilitate personalized learning tailored to the needs and characteristics of individual learners, which is difficult to achieve through conventional one-size-fits-all instructional approaches (Baskara et al., 2023; Zawacki-Richter et al., 2019). Previous research has also reported that AI has the potential to improve the quality of higher education through adaptive learning systems and learning analytics capable of modeling student learning profiles, providing automated feedback, and adjusting learning materials, ultimately contributing to improved academic performance (Hariyanto et al., 2025; Zawacki-Richter et al., 2019). Furthermore, AI technologies can identify difficulties in understanding complex concepts and provide timely interventions to support student learning.

However, the successful implementation of educational technology is not determined solely by the availability of technological tools, but also by the quality of their integration into pedagogical practices and classroom learning activities (Mekheimer, 2025; Subroto et al., 2023). In practice, the utilization of AI in Indonesian higher education remains suboptimal and is often limited to its use as an information retrieval tool rather than as a means of knowledge construction (Kasman et al., 2025; Ridwana et al., 2025). Low levels of AI literacy represent a significant challenge in higher education, as the use of AI without adequate conceptual understanding may lead to cognitive offloading and reduce students' engagement in deep thinking processes (Kasneci et al., 2023). Previous studies have also shown that students tend to use AI primarily to complete assignments rather than to develop conceptual understanding (Adams et al., 2023). Furthermore, insufficient AI literacy competencies prevent the technology from contributing optimally to the improvement of learning quality (Kudriani et al., 2023). Therefore, although AI is widely recognized for its potential to enhance educational quality, concerns remain among both lecturers and students regarding its possible impact on the development of critical thinking skills and academic integrity (Schmidt et al., 2025). In this context, the relationship between lecturers, students, and AI has become increasingly important and worthy of investigation. Consequently, research on the integration of AI into authentic learning environments is urgently needed to ensure that the technology genuinely enhances the quality of student learning.

Previous studies on Artificial Intelligence (AI) in higher education have primarily focused on the effectiveness of AI systems, including adaptive learning, learning analytics, and improvements in academic performance (Kasneci et al., 2023; Zawacki-Richter et al., 2019). In contrast, studies on student creativity have generally examined it as a cognitive or psychological factor influencing learning outcomes independently of AI integration (Runco & Jaeger, 2012). As a result, empirical studies integrating AI-based learning media and student creativity within a single research model remain limited, particularly in the context of the Economic Learning Evaluation course. Moreover, research employing quasi-experimental designs to explain the causal effects of AI utilization in economics education is still relatively scarce. This condition reveals a research gap, namely the lack of empirical models explaining how AI functions not only as a learning support tool but also as a factor that interacts with student creativity in influencing learning outcomes.

Based on this research gap, the present study offers a novel contribution by examining the effects of AI-based learning media and student creativity on learning outcomes through a quasi-experimental approach. Specifically, this study aims to analyze the effect of AI-based learning media on students' learning outcomes, investigate the effect of student creativity on learning outcomes,

and examine the interaction between these two variables in the context of the Economic Learning Evaluation course. This study not only evaluates the effectiveness of AI technology in educational settings but also explores the pedagogical mechanisms that support the development of students' creative thinking processes in understanding learning evaluation concepts. The findings are expected to contribute theoretically to the development of AI-based learning models and to enrich the literature concerning the relationship between AI utilization, student creativity, and learning outcomes. Furthermore, the results are expected to provide a foundation for designing AI-based learning environments that consider creativity as a key factor in enhancing learning success while simultaneously supporting the implementation of quality education as reflected in the objectives of SDG 4.

METHOD

Research Design

This study employed a quantitative method with a quasi-experimental design. The design used was a 2×2 factorial design, which allows the researcher to examine both the main effects and interaction effects between two independent variables on the dependent variable (Creswell & Creswell, 2018; Fraenkel et al., 2011).

This study involved two independent variables: learning media and creativity. The learning media variable consisted of Artificial Intelligence (AI)-based PowerPoint media as the first treatment (A1) and conventional PowerPoint media as the second treatment (A2). Creativity served as a moderator variable and was categorized into high creativity (B1) and low creativity (B2). The dependent variable in this study was students' learning outcomes in the Economic Learning Evaluation course. The factorial design structure is presented in Table 1.

Table 1. 2×2 Factorial Design

B (Creativity)	AI-Based PowerPoint Media (A1)	Conventional PowerPoint Media (A2)	Σb
High (B1)	A1B1 (Y11)	A2B1 (Y21)	Y.1
Low (B2)	A1B2 (Y12)	A2B2 (Y22)	Y.2
Σk	Y1.	Y2.	Y..

Description:

A1B1 (Y11): Students with high creativity taught using AI-based PowerPoint media.

A2B1 (Y21): Students with high creativity taught using conventional PowerPoint media.

A1B2 (Y12): Students with low creativity taught using AI-based PowerPoint media.

A2B2 (Y22): Students with low creativity taught using conventional PowerPoint

Y.1 : Mean learning outcomes of students with high creativity.

Y.2 : Mean learning outcomes of students with low creativity.

Y1. : Mean learning outcomes of students taught using AI-based media.

Y2. : Mean learning outcomes of students taught using conventional media.

Y.. : Overall mean of learning outcomes.

Populasi dan Sampel

The population of this study consisted of 90 fifth-semester students in the Economic Education Study Program, Faculty of Teacher Training and Education, Universitas Panca Sakti Bekasi. From this population, a sample of 60 students was selected, divided into two classes, each consisting of 30 students. Furthermore, each class was divided into two treatment groups, with each group consisting of 15 students. The sampling technique used was cluster random sampling, in which existing classes were randomly selected and assigned as research samples (Creswell & Creswell, 2018).

Data Collection Techniques

The research data were obtained through two instruments, namely a student creativity instrument and a learning achievement test for the Economic Learning Evaluation course. Prior to their use, both instruments were tested for validity and reliability to ensure their suitability as research measurement tools. The validity test included construct validity through expert judgment

(language experts, subject matter experts, and instrument experts) as well as empirical validity through a pilot test conducted with students who were part of the population but outside the research sample. Reliability testing was then conducted to ensure the consistency of the measurement results. After the instruments were declared valid and reliable, they were administered to the research sample. The data collection process was carried out in a coordinated manner under supervision to ensure the completeness and accuracy of respondents' responses.

Data Analysis

The collected data were analyzed in two stages, namely descriptive analysis and inferential analysis. Descriptive analysis was conducted to provide a general overview of the data characteristics for each variable, including mean, median, mode, maximum score, minimum score, range, variance, standard deviation, and data distribution presented in histogram form.

Prior to hypothesis testing, assumption tests were conducted. The normality test was performed using the Kolmogorov-Smirnov test, while the homogeneity of variance was tested using Levene's test. If the data met the assumptions of normality and homogeneity, hypothesis testing was continued using two-way Analysis of Variance (ANOVA). This analysis was used to examine: (1) the main effects of each independent variable on learning outcomes, and (2) the simple effects when a significant interaction between variables was found.

The data tabulation process was carried out collaboratively. Team members were responsible for inputting data into statistical analysis software, while the team leader was responsible for conducting the statistical analysis. The results of the analysis were then documented in the research report and subsequently interpreted by the team leader. Discussion, conclusion drawing, and formulation of research implications were conducted through collaborative discussion between the team leader and members to ensure the accuracy and consistency of the findings. To provide a systematic overview of the research implementation stages, the research procedure is presented in the form of a flow diagram in Figure 1.

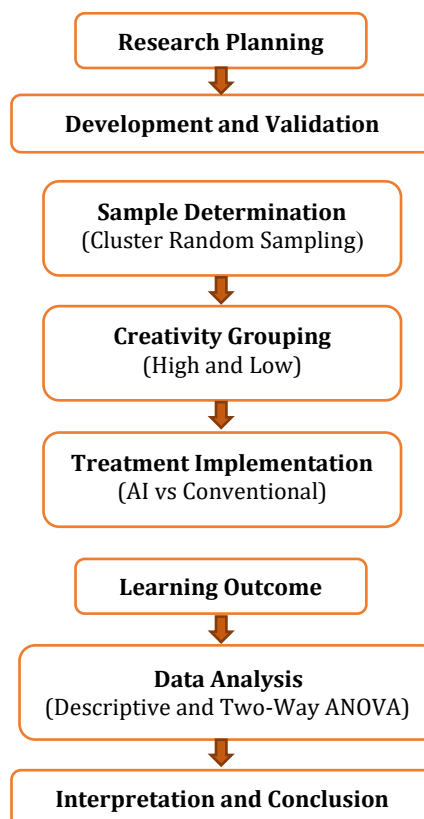


Figure 1. Research Procedure Flow Diagram

RESULTS AND DISCUSSION

Assumption Testing

Prior to hypothesis testing, assumption tests were conducted, including tests of normality and homogeneity. The normality test was performed using the One-Sample Kolmogorov-Smirnov test on the student learning outcome scores across the four treatment groups. The results indicate that all groups obtained significance values greater than 0.05, suggesting that the data were normally distributed. Table 2 presents the results of the normality test for each group.

Table 2. Normality Test Results

Group	Sig.
A1B1	0,200
A1B2	0,121
A2B1	0,089
A2B2	0,156

Based on the normality test results, all groups obtained significance values above 0.05, indicating that the data met the assumption of normality.

Subsequently, a homogeneity test was conducted using Levene's Test of Equality of Error Variances. The results showed a significance value of 0.298 (> 0.05). This indicates that the variance across groups was homogeneous and that the data met the requirements for further analysis using two-way Analysis of Variance (ANOVA). Table 3 presents the results of the homogeneity test using Levene's Test.

Table 3. Homogeneity Test Results (Levene's Test)

Levene Statistic	Sig.
1,245	0,298

These results indicate that the data were drawn from a homogeneous population, allowing the analysis to proceed to the hypothesis testing stage.

Descriptive Statistics

Descriptive analysis was conducted to obtain a general overview of student learning outcomes across the different treatment groups. To present the descriptive results more clearly, Table 4 summarizes the mean scores of student learning outcomes.

Table 4. Mean Scores of Student Learning Outcomes

Learning Media	Creativity	N	Mean	SD
AI (A1)	High (B1)	15	87,13	4,25
AI (A1)	Low (B2)	15	74,40	5,18
Conventional (A2)	High (B1)	15	84,67	4,72
Conventional (A2)	Low (B2)	15	72,87	5,43

Based on Table 4, students with high creativity obtained higher average learning outcomes compared to those with low creativity. The highest mean score was achieved by students with high creativity who were taught using AI-based learning media ($M = 87.13$), whereas the lowest mean score was obtained by students with low creativity who were taught using conventional learning media ($M = 72.87$).

Hypothesis Testing

Hypothesis testing was conducted using a two-way Analysis of Variance (ANOVA) to examine the effects of Artificial Intelligence (AI)-based learning media, student creativity, and their

interaction on student learning outcomes in the course of Economics Education Evaluation. Table 5 presents the results of the two-way ANOVA analysis.

Table 5. Results of Two-Way ANOVA

Source of Variation	SS	df	MS	F	Sig.
Learning Media	18,27	1	18,27	1,42	0,238
Creativity	1125,63	1	1125,63	87,61	0,000
Media × Creativity	68,44	1	68,44	5,33	0,025
Error	719,85	56	12,85		
Total	1932,19	59			

Effect of Artificial Intelligence-Based Learning Media on Learning Outcomes

The results of the two-way ANOVA indicated that Artificial Intelligence (AI)-based learning media did not have a significant effect on students' learning outcomes ($F = 1.42$; $p = 0.238 > 0.05$). Therefore, the hypothesis stating that AI-based learning media influence learning outcomes was not empirically supported.

These findings indicate that the use of AI-based learning media did not produce significantly different learning outcomes compared to conventional learning media within the context of this study. This result differs from the findings of [Liu et al. \(2025\)](#) Who, through a meta-analysis, reported that the use of Generative Artificial Intelligence was generally associated with improvements in students' learning outcomes and motivation. However, their study also showed that the magnitude of AI's impact varied across studies, suggesting that the effectiveness of AI is not always consistent across different learning contexts.

Consistent with the findings of [Kasneci et al. \(2023\)](#), the benefits of AI in education depend not only on the capabilities of the technology itself but also on how learners interact with the technology and the extent of their engagement in the learning process. Furthermore, [Firmansyah et al. \(2026\)](#) reported that the effectiveness of generative AI is associated with user readiness, digital literacy, and strategies for technology utilization in learning. Similarly, [Abdelghani et al. \(2023\)](#) argued that the application of AI in education still requires further investigation regarding student engagement and the learning experiences it generates.

A synthesis of these studies suggests that the implementation of AI in education does not necessarily produce the same impact across all learning situations. Therefore, the findings of the present study provide additional empirical evidence that AI does not always lead to significant improvements in learning outcomes. These findings also extend previous studies that primarily emphasized the potential of AI to support learning by demonstrating that its effectiveness should be understood in relation to implementation context and learner characteristics.

Accordingly, the findings do not indicate that AI directly improves learning outcomes; rather, they suggest that the benefits of AI may vary among students with different characteristics. In this study, creativity appeared to be one of the factors associated with differences in learning outcomes among students using AI-based learning media. This finding addresses the research gap identified in the introduction, namely the limited empirical evidence concerning the relationship between AI-based learning media and student creativity in influencing learning outcomes within the context of economics education. Thus, the results suggest that the use of AI-Based PowerPoint did not demonstrate a significant advantage over conventional presentation media in this particular educational setting.

Effect of Creativity on Learning Outcomes

The results of the two-way ANOVA revealed that creativity had a significant effect on students' learning outcomes ($F = 87.61$; $p = 0.000 < 0.05$). Therefore, the second hypothesis was accepted. Students with high levels of creativity achieved better learning outcomes than those with low levels of creativity. Creativity enables students to explore various alternative solutions, connect concepts learned during instruction, and develop a deeper understanding of learning materials.

These findings support the theory proposed by [Runco & Jaeger \(2012\)](#), who defined creativity as the ability to generate ideas that are both novel and useful in solving problems. Creative students tend to be more actively engaged in learning processes, demonstrate flexible thinking, and develop more effective learning strategies, all of which may contribute to improved learning outcomes.

The findings are also consistent with the study conducted by [Amrin \(2017\)](#), which found that student creativity had a positive and significant effect on accounting learning achievement. Students with higher levels of creativity tended to achieve better academic performance, with creativity contributing 35.046% to learning achievement. Similarly, [Azzahra et al. \(2024\)](#) reported that creativity positively contributed to university students' academic achievement, with higher levels of creativity generally associated with better academic performance. Their study also identified variations in creativity and academic achievement based on age and gender ([Azzahra et al., 2024](#)).

Overall, the results demonstrate that creativity has a significant influence on students' learning outcomes. These findings reinforce previous studies that identified creativity as an important factor in academic success. Moreover, this study contributes to the existing literature by showing that the effect of creativity remains significant in learning environments that incorporate Artificial Intelligence (AI) technologies. Consequently, the effectiveness of AI-based learning may not solely depend on the sophistication of the technology employed but may also be associated with students' creative thinking capacities when engaging with learning activities.

Interaction Between Artificial Intelligence-Based Learning Media and Creativity on Learning Outcomes

The results of the two-way ANOVA indicated a significant interaction between Artificial Intelligence-based learning media and creativity on students' learning outcomes ($F = 5.33$; $p = 0.025 < 0.05$). Therefore, the third hypothesis was accepted.

These findings suggest that the relationship between AI-based learning media and learning outcomes varies according to students' levels of creativity. Students with high creativity tended to achieve better learning outcomes than those with low creativity across the learning media conditions. In the Economic Learning Evaluation course, creativity is relevant for designing assessment instruments, analyzing evaluation results, and formulating alternative solutions based on available data. Therefore, differences in creativity levels may be associated with differences in how students engage with learning activities supported by AI-based media.

The findings are consistent with those of [Muktar & Burhan \(2025\)](#), who reported that the use of AI positively influenced students' learning creativity. Likewise, [Habib et al. \(2024\)](#) found that generative AI could support several dimensions of creative thinking, including fluency, flexibility, and elaboration. These findings are further supported by [Lin & Chen \(2024\)](#), who argued that the use of AI in learning is associated with creativity development and improvements in learning quality. Collectively, these studies suggest that the potential benefits of AI may be related not only to technological capabilities but also to learner characteristics.

This study contributes to the literature by demonstrating that the relationship between AI and learning outcomes should not be examined independently of student characteristics, particularly creativity. Therefore, the implementation of AI-based learning in higher education may benefit from being accompanied by instructional strategies that support the development of students' creativity, thereby enhancing the potential educational value of AI technologies.

LIMITATION

This study has several limitations that should be considered when interpreting the findings. First, the study was conducted only among students enrolled in the Economics Education Evaluation course at a single university; therefore, the generalizability of the findings to other courses, study programs, or institutions should be made with caution. Second, the study focused on cognitive learning outcomes and student creativity and did not examine other factors that may influence the effectiveness of AI-based learning, such as learning motivation, digital literacy, critical thinking skills, and experience in using AI. Third, the study did not provide a detailed identification

of students' AI usage patterns during the learning process; therefore, the mechanisms through which AI influences learning outcomes at different levels of creativity still require further investigation. Therefore, future research is recommended to involve larger and more diverse samples, include additional moderating or mediating variables, and combine quantitative and qualitative approaches in order to obtain a more comprehensive understanding of AI utilization in learning.

CONCLUSION

Based on the results and discussion, it can be concluded that Artificial Intelligence (AI)-based learning media does not show a significant effect on students' learning outcomes in the Economics Education Evaluation course. The results of the study indicate that the average learning outcomes of students who used AI-based PowerPoint and conventional PowerPoint were relatively not significantly different. Student creativity was proven to have a significant effect on learning outcomes. Students with high levels of creativity demonstrated better learning outcomes compared to students with low levels of creativity. This indicates that creativity is one of the important factors that support the success of the learning process in higher education.

This study also found a significant interaction between Artificial Intelligence (AI)-based learning media and creativity on learning outcomes. These findings indicate that the relationship between learning media and learning outcomes differs at different levels of creativity.

This study also found a significant interaction between Artificial Intelligence (AI)-based learning media and creativity on learning outcomes. These findings indicate that the relationship between learning media and learning outcomes differs at different levels of creativity.

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