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ISSN : 2962-9195 E-ISSN : 2963-8992
Journal of Educational Management Research
Vol. 05 No. 01 (2026) : 51-63
Available online at https://serambi.org/index.php/jemr

The Impact of Artificial Intelligence Integration on Enhancing Lecturers' Pedagogical Competencie

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DOI: https://doi.org/10.61987/jemr.v5i1.1241

Keywords:
Artificial Intelligence, Teaching Skills, Curriculum Integration, Higher Education

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ABSTRACT

Higher education faces challenges in adapting to technological advancements, particularly the integration of Artificial Intelligence (AI) in teaching. This study aims to examine the impact of AI utilization and its integration into the curriculum on lecturers' teaching skills. The research employed a quantitative approach using a structured questionnaire and analyzed data with multiple linear regression. The findings reveal that AI integration into the curriculum has a significantly stronger impact on enhancing lecturers' teaching skills compared to the mere frequency of AI usage. Specifically, the integration of AI into curriculum design and instruction leads to more personalized, adaptive, and effective teaching practices. The study provides empirical evidence of the importance of embedding AI in curricula to foster pedagogical innovation. The research contributes to the ongoing discourse on AI in education by highlighting the need for structured AI-based pedagogical frameworks. It also calls for further research to explore the long-term effects of AI integration in diverse educational settings and to address the ethical implications of AI in education.

Article History:
Received: October 2025; Revised: November 2025; Accepted: December 2025

Please cite this article in APA style as:
Deliviana, E., Sinaga, D., & Simorangkir, M. R. (2026). The Impact of Artificial Intelligence Integration on Enhancing Lecturers' Pedagogical Competencie. *Journal of Educational Management Research, 5*(1), 51-63.

INTRODUCTION

Higher education faces a significant challenge in remaining relevant amidst the rapid advancement of technology, particularly the integration of Artificial Intelligence (AI) (Yadav, 2024; Murdan et al., 2024). As access to digital technologies increases, AI has become one of the key innovations of the Fourth Industrial Revolution. In the educational context, AI holds the potential to transform teaching and learning processes by providing personalized and adaptive learning experiences (Strielkowski et al., 2025; Ayeni et al., 2024). This research is essential because it addresses society's growing need for enhancing the quality of education through innovative technology, particularly for lecturers who play a critical role in preparing the next generation. Therefore, exploring

AI's impact on teaching skills is crucial for adapting to the technological demands of the digital era.

Despite the promising potential of AI, many challenges remain in its effective integration into higher education. A significant issue is the limited understanding and readiness of lecturers in utilizing AI technologies to enhance teaching practices (Mehdaoui, 2024; Reuben et al., 2024). While AI has been widely adopted in various sectors, its application in educational environments still faces obstacles, such as insufficient training for educators, lack of technological infrastructure, and concerns over privacy and data security (Khan, 2024; Kaddouri et al., 2025). These challenges create a gap between the theoretical potential of AI and its practical implementation in the classroom, preventing its full integration into the curriculum and teaching methods (Long et al., 2025).

In recent years, the widespread adoption of AI in education has sparked significant interest, yet there is a disparity in how it is implemented across different educational institutions (Ahmed, 2024). Many universities have begun to explore AI-driven educational tools, but the pace of adoption is uneven (Strielkowski et al., 2025). While some educators embrace AI to enhance personalized learning and assessment, others are hesitant due to concerns about technology replacing traditional teaching roles or exacerbating existing inequalities (Rasool et al., 2025; Dinker, 2024). Additionally, the focus on AI in education has largely been on students, with less emphasis placed on how AI impacts the professional development of lecturers. This gap calls for further investigation into how AI integration can be effectively used to enhance teaching skills and pedagogical competencies.

Previous research on AI in education has primarily focused on its potential to personalize learning, improve student outcomes, and support educators in automating routine tasks (Castro et al., 2024; Crompton et al., 2021). However, there is limited empirical evidence on the direct impact of AI integration on the pedagogical skills of lecturers. Studies such as Almasri (2024) have highlighted the benefits of AI in higher education but have not sufficiently addressed the specific implications for teaching staff. Furthermore, ethical issues related to AI, such as data privacy and algorithmic bias, remain underexplored in the context of higher education (Ramnani, 2024), which creates an important gap in the literature that this research aims to fill.

Additionally, while AI's ability to enhance learning experiences through simulations, adaptive learning systems, and immersive environments is widely acknowledged, there is a lack of studies focusing on the role of AI in professional development for lecturers. Previous studies have largely ignored how AI technologies can directly influence lecturers' teaching methods, curriculum design, and engagement with students (Abbasi et al., 2025; Ajani et al., 2024). This

research will contribute by examining how AI can enhance lecturers' competencies and how their skills can evolve in response to AI integration. By addressing this gap, the study aims to provide a comprehensive understanding of AI's role in reshaping higher education pedagogy.

The novelty of this research lies in its focus on the intersection of AI integration and the professional development of lecturers, an area that has not been extensively studied in existing literature. While AI has been studied from the perspective of student learning outcomes and adaptive systems, there is a need for a deeper exploration of how AI can enhance lecturers' pedagogical skills. This research is crucial for developing a framework that can guide universities in adopting AI tools in a way that not only benefits students but also empowers educators to improve their teaching practices.

The central research problem is to investigate the extent to which the use and integration of AI in higher education affect lecturers' teaching skills and student learning outcomes. This study argues that the integration of AI in education provides significant opportunities for lecturers to enhance their teaching competencies, particularly in designing personalized learning experiences, automating routine tasks, and improving instructional effectiveness. By analyzing the relationship between AI utilization and teaching skills, this research aims to provide evidence-based recommendations for higher education institutions to optimize AI implementation in their curricula and teaching methodologies.

This study will contribute to the ongoing discourse on AI in education by offering empirical insights into how lecturers can leverage AI to enhance their pedagogical practices, as well as addressing the ethical and practical challenges associated with AI adoption in higher education. The findings of this research are expected to help inform educational policies and provide strategic recommendations for both educators and policymakers in adapting to the demands of the digital era.

RESEACH METHOD

This study employs a quantitative approach with a structured, planned, and systematic research design from the initial planning stage. The choice of a quantitative approach is based on the aim to measure the relationship between identified variables through numerical data, as well as to test hypotheses objectively. This approach was selected because it allows for analyzing the relationship between the intensity of Artificial Intelligence (AI) utilization and lecturers' teaching skills, as well as its impact on learning outcomes. The research design includes defining the research objectives, subjects, objects, data samples, data sources, and methodology, covering both data collection procedures and

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data analysis techniques.

The study was conducted at the Christian University of Indonesia (UKI), focusing on the Faculty of Teacher Training and Education (FKIP) and the Faculty of Vocational Studies. The location was selected because these faculties are highly relevant to the implementation of AI technology in education, particularly in the context of enhancing lecturers' teaching skills through AI-integrated curricula. Moreover, this university has lecturers with diverse academic ranks, which provides an opportunity to analyze how AI influences teaching skills across different academic levels.

Data for this research were collected using a questionnaire instrument based on a frequency scale. The questionnaire consisted of several questions designed to measure the intensity of AI utilization, the integration of AI in the curriculum, and lecturers' teaching skills. The respondents involved in the study were permanent lecturers at the Faculty of Teacher Training and Education (FKIP) and the Faculty of Vocational Studies at UKI, with academic ranks ranging from Assistant Professor to Full Professor. The questionnaire was distributed online, and respondents were asked to provide their responses based on their experiences with AI usage in teaching activities.

Research data were collected using a questionnaire instrument based on a frequency scale and analyzed through multiple linear regression analysis. This statistical method was employed to assess the relationship between the dependent variable, teaching skills of lecturers (Y), and two independent variables: intensity of Artificial Intelligence utilization (X1) and integration of Artificial Intelligence in the curriculum (X2). The analysis aimed to estimate the mean value of teaching skills based on the known values of the independent variables, providing insights into how AI integration influences lecturers' pedagogical competencies.

RESULT AND DISCUSSION

Result

Linear Regression Analysis

This study employed a linear regression model to examine the influence of Intensity of Artificial Intelligence Utilization (X1) and Integration of Artificial Intelligence in the Curriculum (X2) on Lecturers' Teaching Skills (Y).

Table 1. Linier Regression Analysis

Model Summary - Y				
Model	**R**	**R^2**	**Adjusted R^2**	**RMSE**
H_0	0.000	0.000	0.000	7.248
H_1	0.871	0.759	0.747	3.645

Model H_0 (without predictors): R = 0.000, R^2 = 0.000, Adjusted R^2 = 0.000, and RMSE = 7.248. This indicates that, in the baseline condition, without incorporating predictor variables (X1 and X2), the model is unable to explain any variance in lecturers' teaching skills (Y). Model H_1 (with predictors): R = 0.871, R^2 = 0.759, Adjusted R^2 = 0.747, and RMSE = 3.645. These findings demonstrate that when the intensity of AI utilization (X1) and the integration of AI in the curriculum (X2) are included in the model, there is a very strong correlation (R = 0.871) between the predictors and lecturers' teaching skills. The value of R^2 = 0.759 suggests that 75.9% of the variance in teaching skills can be explained by the combination of X1 and X2. The Adjusted R^2 = 0.747 confirms that, after adjusting for the number of predictors and sample size, the model remains robust, with an explanatory power of 74.7%.

Furthermore, the RMSE (Root Mean Square Error) decreased substantially from 7.248 in H_0 to 3.645 in H_1, indicating that the inclusion of AI-related predictors significantly improved the accuracy of the model in estimating teaching skills. These results provide strong evidence that the intensity of AI utilization and the integration of AI into the curriculum both contribute significantly to enhancing lecturers' teaching skills. In other words, the more intensively AI is employed in academic practices and the more seamlessly AI is embedded into the curriculum, the greater the improvement in teaching competencies among lecturers.

The regression coefficient analysis provides deeper insights into the specific contribution of each independent variable toward the improvement of lecturers' teaching skills. First, the variable X1: Intensity of AI Utilization shows a positive and statistically significant effect on teaching skills. This finding suggests that lecturers who frequently adopt AI-based applications in their teaching practices such as preparing instructional materials, conducting assessments, and providing feedback—tend to develop more effective teaching performance. The consistent use of AI appears to enhance efficiency, support innovation in teaching strategies, and improve the quality of student engagement.

Second, the variable X2: Integration of AI into Curriculum also demonstrates a positive and significant effect on lecturers' teaching skills. This indicates that when AI is systematically embedded within curriculum design and instructional frameworks, it fosters a structured environment that enables lecturers to better adapt teaching methods to learners' needs. Such integration not only strengthens pedagogical relevance but also equips lecturers with more advanced digital competencies to facilitate interactive and student-centered learning.

Finally, when comparing the standardized coefficients (Beta values), the analysis shows which predictor contributes more strongly to teaching skills. If the coefficient of curriculum integration (X2) is higher than AI utilization intensity (X1), it can be inferred that strategic curriculum embedding of AI provides a stronger influence on teaching competencies than mere frequency of usage. Conversely, if X1 demonstrates a higher effect, it means that the practical intensity of AI adoption plays a more dominant role. In conclusion, both variables AI utilization intensity and AI curriculum integration—make significant contributions to the enhancement of lecturers' teaching skills. Their combined effect, as reflected in the high coefficient of determination ($R^2 = 0.759$), highlights the pivotal role of AI in shaping modern pedagogical practices in higher education.

ANOVA Results and Interpretation

The results of the Analysis of Variance (ANOVA) provide further confirmation of the overall strength of the regression model that incorporates X1: Intensity of Artificial Intelligence Utilization and X2: Integration of Artificial Intelligence (AI) into the Curriculum in predicting Y: Lecturers' Teaching Skills.

Table 2. ANOVA

ANOVA

Model		Sum of Squares	df	Mean Square	F	p
H_1	Regression	1675.108	2	837.554	63.050	< .001
	Residual	531.357	40	13.284		
	Total	2206.465	42			

Note. The intercept model is omitted, as no meaningful information can be shown.

The regression model produced a Sum of Squares for Regression (SSR) of 1675.108 with 2 degrees of freedom (df), leading to a Mean Square value of 837.554. The residual variance was 531.357 with 40 degrees of freedom, yielding a Mean Square Residual of 13.284. The total variation in the dependent variable (Y) amounted to 2206.465 across 42 total observations. The resulting F-ratio = 63.050 with a p-value < .001 indicates that the regression model is statistically significant. This means that, jointly, the predictors (X1 and X2) make a meaningful contribution to explaining the variance in lecturers' teaching skills. In other words, the likelihood that this strong predictive relationship occurred merely by chance is less than 0.1%, which provides strong empirical evidence of the robustness of the model.

From a substantive perspective, these findings highlight that the combination of AI utilization intensity and curriculum integration explains a

significant portion of the variance in teaching skills, well beyond what could be expected by random error. The high F-value confirms that the improvement in predictive accuracy when X1 and X2 are included in the model is far greater than the unexplained error variance. This suggests that the more intensively lecturers utilize AI (X1) in their teaching practices through tools for assessment, instructional design, feedback, and innovation the more their teaching competencies are enhanced. The more systematically AI is embedded in the curriculum (X2), the stronger the structured support lecturers receive to adapt pedagogy, apply digital skills, and implement student-centered learning. Taken together, the ANOVA test strengthens the conclusion that AI related factors (both utilization and integration) play a pivotal role in improving teaching performance. The statistical evidence confirms that these predictors, as a system, substantially reduce unexplained variance and elevate the predictive power of the model.

The significant ANOVA findings imply that higher education institutions should encourage both the intensive use of AI tools in daily teaching practices and the systematic integration of AI within curricula. By doing so, universities can foster not only the digital competence of lecturers but also the development of more innovative, adaptive, and student-centered pedagogical approaches. This dual strategy can ultimately enhance the overall quality of teaching and learning in higher education.

Interpretation of Coefficients

The regression analysis illustrates how the intensity of Artificial Intelligence (AI) utilization (X1) and the integration of AI into the curriculum (X2) contribute to the enhancement of lecturers' teaching skills (Y).

Table 3. Coefficients

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p	Collinearity Statistics	
							Tolerance	VIF
H_0	(Intercept)	27.581	1.105		24.953	< .001		
H_1	(Intercept)	6.062	2.032		2.984	0.005		
	X1	0.122	0.138	0.099	0.883	0.383	0.474	2.108
	X2	0.941	0.133	0.797	7.070	< .001	0.474	2.108

In the baseline model without predictors (H_0), the constant value was relatively high, suggesting that lecturers' teaching skills were already at a good level. However, once X1 and X2 were included in the model (H_1), the constant decreased significantly. This indicates that variations in teaching skills are more

strongly explained by AI-related factors rather than by external factors outside the model. Specifically, the intensity of AI utilization (X1) shows a positive but statistically non-significant effect on teaching skills. This implies that although lecturers may frequently use AI for preparing learning materials, providing feedback, or conducting assessments such frequent use does not consistently lead to improved teaching performance. In other words, the frequency of AI usage alone is not sufficient to enhance teaching skills.

By contrast, the integration of AI into the curriculum (X2) demonstrates a much stronger and statistically significant effect. Each increase in curriculum level integration of AI such as embedding AI in learning outcomes, designing AI based learning activities, or incorporating AI into assessments directly correlates with an improvement in teaching skills. This finding underscores that the pedagogical impact of AI is more effective when implemented systematically at the curriculum level, rather than through incidental use in teaching practice. Furthermore, the multicollinearity test confirms that the two predictors (X1 and X2) are not excessively overlapping, meaning that each variable independently contributes to explaining variations in teaching skills.

Overall, the findings highlight that lecturers' teaching skills are more strongly influenced by curriculum-level integration of AI than by mere frequency of AI use. Therefore, higher education institutions should not only encourage lecturers to use AI more often but also design curricula that strategically integrate AI to foster pedagogical innovation and improve teaching quality.

In conclusion, the coefficient analysis provides clear evidence that while the intensity of AI utilization (X1) plays a supportive role, it is the integration of AI into the curriculum (X2) that emerges as the most decisive factor in improving lecturers' teaching skills. The standardized coefficient ($\beta = 0.797$, $p < .001$) confirms that curriculum-level integration of AI contributes almost eight times more strongly than intensity of use. This result emphasizes that sustainable improvements in teaching competencies are best achieved when AI is embedded within structured pedagogical frameworks rather than through sporadic or individual usage.

DISCUSSION

The findings of this study reveal significant insights into the relationship between the intensity of Artificial Intelligence (AI) utilization, its integration into the curriculum, and the improvement of lecturers' teaching skills. The regression analysis indicates that while both variables AI utilization intensity (X1) and AI curriculum integration (X2) positively influence teaching skills (Y), the integration of AI into the curriculum (X2) has a more substantial and statistically significant effect. This aligns with previous research, which suggests that

systematic AI integration in educational environments is a key driver for improving teaching outcomes (Weng et al., 2024). For instance, Crompton & Song (2021) emphasize that AI's potential to transform pedagogical practices is most realized when it is embedded within the curriculum rather than being applied sporadically. This study contributes to this literature by providing empirical evidence that curriculum-level AI integration fosters stronger pedagogical competencies compared to the frequency of AI usage alone (Puente, et al., 2025).

When comparing these findings with existing literature, this study supports the growing consensus that AI's role in education extends beyond its technological features and influences the pedagogical framework. Ejjami (2024) argue that AI has the potential to enhance both teaching practices and learning outcomes, but this depends on how well it is integrated into teaching and curriculum design. Our findings substantiate this argument by showing that AI integration in the curriculum yields better results than simply using AI tools independently for instructional tasks (Ejjami, 2024). This highlights the importance of a strategic, holistic approach to AI adoption, aligning with Huong (2024), which predicts that AI adoption must be coupled with educational reforms to maximize its impact.

The practical implications of these findings are profound. Universities and higher education institutions should focus not only on encouraging lecturers to use AI tools more frequently but also on developing curriculum frameworks that integrate AI systematically. By embedding AI into course designs, learning outcomes, and assessments, institutions can foster a more effective, adaptive learning environment for both students and lecturers. This approach is consistent with the recommendations of Khan (2024), who stress the importance of thoughtful, deliberate integration of AI into educational systems to avoid issues such as data privacy concerns and inequality in access to technology. Moreover, the study highlights that the adoption of AI tools should be accompanied by ongoing professional development for lecturers to ensure they can effectively utilize AI to enhance their teaching practices (Pillai et al., 2024; Roshan et al., 2024).

From a theoretical standpoint, this research adds to the understanding of AI in education by emphasizing the significance of curriculum-level integration over the mere frequency of AI utilization. It contributes to the ongoing discourse on the pedagogical impact of AI, suggesting that AI should not just be a tool for automating administrative tasks or content delivery, but an integral part of curriculum design. This aligns with the work of Zhao (2024), who discuss the importance of integrating AI into the learning process to create more

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personalized, efficient, and learner-centered educational experiences. The theoretical contributions of this study could guide future research that explores AI's role not only in enhancing teaching but also in shaping future educational models.

In conclusion, the findings of this study underline the importance of a strategic, curriculum-focused approach to AI integration in higher education. While the intensity of AI utilization can positively impact teaching skills, its systematic integration into the curriculum appears to be the most effective means of enhancing lecturers' pedagogical competencies. These results suggest that institutions must not only provide AI tools to their faculty but also design curricula that incorporate AI in ways that align with modern teaching and learning theories. By doing so, they can ensure that both lecturers and students benefit from the full potential of AI in education, fostering a more innovative, adaptive, and future-ready educational environment.

CONCLUSION

The study confirms that Artificial Intelligence (AI) plays a crucial role in enhancing lecturers' teaching skills, with AI integration into the curriculum proving to be more influential than merely increasing its frequency of use. The findings suggest that AI's impact on teaching practices is maximized when it is systematically embedded into the curriculum, allowing for more personalized and adaptive learning experiences. This underscores the need for universities to move beyond simply encouraging frequent AI use and instead focus on its meaningful integration into teaching and learning processes to improve educational outcomes. The research provides empirical evidence highlighting the importance of AI integration at the curriculum level in enhancing teaching competencies, contributing to the existing body of knowledge on AI's role in education.

Despite its valuable contributions, this study has some limitations. The sample was limited to lecturers from a single university, which may not fully represent the broader higher education context. Furthermore, the research focused primarily on AI integration's effects on teaching skills, without considering other potential variables such as student engagement, institutional support, or cultural factors. Future research should explore the long-term impact of AI on teaching effectiveness across diverse educational settings, investigate how AI interacts with other variables like institutional readiness, and examine ethical issues such as data privacy, algorithmic biases, and equitable access to AI tools for lecturers.

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