The Impact of AI Application Utilization and Innovation Learning on Academic Achievement Students in the Society 5.0 Era

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Abstract
The purpose of this study is to determine the effect of AI Application Utilization and Learning Innovation on Student Academic Achievement in the Society 5.0 Era. The research approach used is a quantitative approach with a population of students currently studying in Asahan Regency. The classical assumption tests used in this study were normality, heteroscedasticity, and multicollinearity tests. The regression test used in this study was multiple linear regression. The hypothesis tests used in this study were the F test, t test, and R2test. The results of this study show that simultaneously, the independent variables consisting of AI Application Utilization (X1), Learning Innovation (X2), have a positive and significant effect on the dependent variable, namely Academic Achievement (Y).
Keywords: Academic Achievement; *AI Application Utilization;* Learning Innovation

INTRODUCTION

Artificial Intelligence (AI) has become one of the technologies that is widely used by everyone, including in Indonesia. Society 5.0 is a concept initiated by the Japanese government that considers technological aspects to make human life easier, or a concept of a human-centered and technology-based society in the implementation of a technological base that will continue to develop (Widyastuti, 2024). The development of academic information systems is an important element in supporting the success of higher education institutions, especially in global competition (Tahsinia et al., 2025). The existence of ChatGPT has made many students dependent on it to search for information and help with academic assignments (Ifani et al., 2024). The presence of AI-based technology not only affects how educators design learning strategies, but also changes student learning behavior (Gunen et al., 2025). For students, ChatGPT has become an alternative learning resource that helps them understand lecture material, complete academic assignments, and save time in searching for references. This has the potential to increase student motivation, engagement, and learning achievement.

This study aims to reveal trends, key findings, and gaps in research related to AI in student education. The results of this study are expected to serve as a reference for the development of more effective policies and strategies to utilize AI in supporting student learning in the digital age (Tittahira et al., 2025). Technology has had a significant impact on the advancement of education, especially at the university level. The Artificial Intelligence (AI) function embedded in ChatGPT enables it to acquire knowledge through simple and complex methods, thereby generating relevant responses (Ainayya, 2025). AI also has the potential to create and scale personalized learning, optimize learning strategies, and improve access for diverse populations (Dawam et al.,2025). AI-based learning systems can analyze students' individual learning needs and tendencies, providing recommendations for materials and methods that match their level of understanding and interests (Lestari & Buhungo, 2023).

However, there are many challenges associated with its use, such as the possibility of academic cheating, the potential reduction of interaction between lecturers and students, and

the importance of interaction in the learning process for improving social and emotional skills (Tittahira et al., 2025). Student academic well-being is a crucial dimension that involves psychological, emotional, and social aspects in the context of education. Academic stress and *burnout* are two significant phenomena experienced by many students in various universities (Yusufi et al., 2025). In this article, the research will systematically describe how AI is used in learning and assessment activities (Oktavianus et al., 2023). The success of learning in this context is not only measured by final grades, but also by critical thinking skills, collaboration, and students' readiness for lifelong learning. The main focus of this research is to identify the role of AI in the student learning process and to evaluate the level of understanding, frequency of use, perceptions of the benefits and risks, and lecturers' attitudes towards this technology. The impact of AI integration is already evident, particularly through the use of digital applications such as ChatGPT, Canva, and Gemini AI. These tools support students in organizing their work, improving language use, creating visually appealing presentations, and obtaining information quickly and efficiently (Hayat et al., 2025).

AI in education can help educators understand student learning patterns more deeply and provide specific, *real-time* feedback. The development of learning media over time reflects how technology continues to change the way we convey and access knowledge (Amalia et al., 2024) . Therefore, this study aims to examine how AI can be integrated with deep learning to improve the quality of education and identify the challenges and obstacles that may be encountered in the implementation process (Riomalen et al., 2025). AI is an algorithm-based intelligent system capable of mimicking human intelligence in managing data, recognizing patterns, analyzing, and automatically generating decisions (Wijaya et al., 2025). The role of AI in personalizing learning focuses on innovation, opportunities, and future challenges. The main motivation is the urgent need for adaptive education systems to meet the diverse needs, speeds, and learning styles of students, overcoming the limitations of traditional approaches (Suhendry et al., 2025). *Artificial Intelligence* learning systems can analyze data on individual learning progress and provide additional or repeated material if necessary. Overall, the role *of Artificial Intelligence* in student learning has great potential to change the educational paradigm (Putri et al., 2023).

In this context, ChatGPT serves as digital scaffolding, helping students access knowledge, evaluate understanding, and boost confidence in completing academic tasks, where students perceive AI like AIDA (Digital Assistant) as a tool that not only helps academically, but also provides emotional and social support, which is a key characteristic of AI-based digital scaffolding (Siswanto et al., 2025). Therefore, AI offers a variety of innovative solutions to improve the quality of learning. With its ability to manage large amounts of data and recognize individual learning patterns, AI can help design more adaptive and personalized learning methods. In addition, AI can also be used to develop visual and interactive tools that make concepts easier to understand and apply (Mujib, 2025). The use of Artificial Intelligence (AI) in education can have a significant impact on students' interest in learning. AI can make learning more interactive and enjoyable by providing content tailored to students' interests and learning styles, thereby increasing their enjoyment of learning. AI-based smart assessment

tools can analyze student performance in real-time and provide specific and relevant feedback (Muchminiin et al., 2024).

The use of AI in education not only creates a more efficient learning environment but also helps reduce the burden on teachers. By automating administrative tasks and data analysis, AI can help reduce teachers' workload so they can focus on teaching and supporting students. The benefits of AI technology in education have proven to be one of the most effective online exam solutions (Anas et al., 2024). Several studies show that reliance on AI can reduce critical thinking and conceptual understanding, especially in completing complex tasks. The use of artificial intelligence (AI) significantly improves students' academic abilities because it allows access to extensive educational resources, real-time feedback, and customized learning (Sabrina et al., 2025). Artificial intelligence can influence student behavior in academic fields, such as increasing interaction with educators, providing quick feedback, and personalizing learning according to student needs (Hidayat, 2024). Academic grades indicate student learning achievements at an institution, while learning achievements are one indicator of the degree of change in student behavior (Trisna & Putri, 2022). In addition, learning achievement can also open doors to opportunities to continue education, get a job, and achieve success in one's career. Therefore, achievement in learning cannot be separated from learning activities, because learning is a process while achievement is the result (Munira et al., 2024).

In addition, academic achievement can also open doors to opportunities for continuing education, obtaining employment, and achieving career success. Therefore, achievement in learning cannot be separated from learning activities, because learning is a process while achievement is the result (Munira et al., 2024). Strong knowledge extension by students will have a significant impact on cognitive achievement, which is reflected in academic achievement, making it crucial for lecturers to improve students' understanding to enhance their ability to develop critical and analytical thinking skills through data-based learning experiences (M et al., 2025). Students who proactively utilize artificial intelligence technologies, such as ChatGPT, Grammarly, and AI translators, typically experience improvements in their understanding of course material, the quality of their assignments, and their Grade Point Average (GPA) (Nariswari et al., 2025). By utilizing AI, these activities can be carried out more efficiently and quickly (Siswanto et al., 2025).

Academic grades indicate student learning achievement at an institution, while learning achievement is one indicator of the degree of change in student behavior. The results of teaching and learning interactions are usually reflected in the test scores given by lecturers. Based on the above description, it can be concluded that learning outcomes are the results obtained by students after the learning process, as indicated by test scores on the main subject matter (Rabaani & Indriyani, 2024) . GPA is one of the best predictors of the success of higher education institutions in academic activities because it shows student achievement during their studies at the university (Trinandari PN, 2022).

In view of the rapidly growing literature on artificial intelligence in higher education, this study narrows the focus from general AI applications to the specific use of ChatGPT as an AI-based academic tool among university students. Existing studies have largely discussed the potential and challenges of AI in education at a conceptual level, but there is still limited

empirical evidence on how the actual use of ChatGPT relates to students' academic achievement (as reflected in GPA) and their academic well-being in the Indonesian higher education context. This research therefore aims to examine the frequency and patterns of ChatGPT use for academic purposes, students' perceptions of its benefits and risks, and their academic well-being, and to analyze how these factors are associated with academic performance. By explicitly positioning ChatGPT as the main object of investigation and academic achievement and academic well-being as the core outcome variables, this study addresses a clear research gap and provides a more directed contribution beyond general discussions of AI in education.

METHOD

This study uses a quantitative method, which is effective in describing education phenomena based on numerical data that can be analyzed statistically. The population of this study consists of active students in Asahan Regency who have used AI technology in learning. In this study, data processing was carried out using SPSS (Statistical Program for Social Sciences) version 27 software. The classical assumption tests used in this study were normality tests, multicollinearity tests, and heteroscedasticity tests. The hypothesis tests used were multiple linear regression tests, F tests (simultaneous), t tests (partial), and R^2 tests (coefficient of determination) (Syera et al., 2025).

RESULTS

Classical Assumption Test

A good regression model must not have any classical assumption problems in its model. If there are still classical assumptions, then the regression model has bias. The following are the results of the classical assumption test on the effect of *AI application utilization* and learning innovation on the academic achievement of students in Asahan Regency.

Normality Test

The normality test aims to determine whether the disturbance variables or residuals in the regression model have a normal distribution. In this study, the normality test used *the One Sample Kolmogorov-Smirnov Test*. The normality test table is as follows:

Table 1. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		LAG_RES
N		59
Normal Parameters [a,b]	Mean	.0235
	Std. Deviation	2.79320
Most Extreme Differences	Absolute	.070
	Positive	.065
	Negative	-.070
Test Statistic		.070
Asymp. Sig. (2-tailed)[c]		.200[d]

a. Test distribution is Normal.

b. Calculated from data.

Table 1 shows that the results of the normality test, namely the data on a sample of 60 respondents, indicate that the variables of *AI Application Utilization* (X1) and Learning Innovation (X2) on Academic Achievement (Y) are normally distributed. This is proven by the significance value that has exceeded the error rate limit, namely 0.200 > 0.05. Thus, the research variables are normally distributed and can proceed to the next test.

Heteroscedasticity Test

The heteroscedasticity test aims to test whether there will be unequal variance in the regression model from one observation to another, as known in this study, the heteroscedasticity test uses *Glejser*. The following table shows the heteroscedasticity test results:

Table 2. Heteroscedasticity Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.558	2.926		-.874	.386
	LAG_X1	-.027	.112	-.043	-.243	.809
	LAG_X2	.111	.116	.170	.952	.345

a. Dependent Variable: LAG_ABS_RES

Table 2 shows that the results of the heteroscedasticity test using *the Glejser* test indicate significant values (sig.) for variable X (*AI Application Utilization*, Learning Innovation), where the significant values are (0.809; 0.345;) with a sig value > 0.05. Therefore, it can be concluded that there is no heteroscedasticity in the regression model.

Multicollinearity Test

The multicollinearity test aims to test whether the regression model finds a correlation between *independent* variables. The multicollinearity test table is as follows:

Table 3. Multicollinearity Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.375	2.936		2.512	.015		
	LAG_X1	.122	.112	.132	1.090	.281	.559	1,788
	LAG_X2	.621	.117	.643	5,323	.000	.559	1,788

a. Dependent Variable: LAG_Y

Table 3 shows that the regression model does not experience multicollinearity. This can be seen in the tolerance values of each variable, which are greater than the default value of 0.10. Meanwhile, the VIF values are also below 10. Therefore, it can be concluded that there is no multicollinearity between the independent variables in the regression model.

Hypothesis Test Results

Multiple Linear Regression Test Results

Multiple linear regression analysis aims to determine the effect of independent variables, namely *AI Application Utilization* ($_{X1}$) and Learning Innovation ($_{X2}$), on the dependent variable, namely Academic Achievement (Y). The regression test results are as follows:

Table 4. Multiple Linear Regression Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.375	2.936		2,512	.015
	LAG_X1	.122	.112	.132	1.090	.281
	LAG_X2	.621	.117	.643	5,323	.000

Dependent Variable: LAG_Y

Table 4 shows that the results of the multiple linear regression test can be used to create the following linear regression equation: $\mathbf{Y = 7.375 + 0._{122X1} + 0._{621X2}}$

The meaning of the terms in the multiple linear regression equation:

1. The constant value of 7.375 indicates that if the values of the variables *AI Application Utilization* ($_{X1}$) and Learning Innovation ($_{X2}$) = 0 or do not increase, then the value of the Academic Achievement variable (Y) will remain at 7.375. The sig. value of 0.015 (<0.05) indicates that this constant is significant in the model, meaning that there are other factors outside of X1 and X2 that influence Y.
2. The regression coefficient of the *AI Application Utilization* variable ($_{X1}$) is 0.122, which indicates that for every 1% increase in the *AI Application Utilization* variable ($_{X1}$), the Academic Achievement variable (Y) will increase by 0.122%.
3. The regression coefficient for the Learning Innovation variable ($_{X2}$) is 0.621, which indicates that for every 1% increase in the Learning Innovation variable ($_{X2}$), the Academic Achievement variable (Y) will increase by 0.621%.

F Test (Simultaneous Test)

The F test basically shows whether the independent variables included in the model have a combined effect on the dependent variable. The results of the F test can be seen in the following table:

Table 5. F Test Results (Simultaneous Test)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	534.322	2	267,161	33,278	.000[b]
	Residual	449,574	56	8,028		
	Total	983,895	58			

a. Dependent Variable: LAG_Y

b. Predictors: (Constant), LAG_X2, LAG_X1

Table 5 shows that in column df 1 = 2 and df 2 = 56, the f table obtained is $_{ftabel}$ (2;56) of 3.17. From this table, it can be seen that the $_{fhitung}$ value is 33.278, which is greater than $_{ftabel}$ (3.17), and the significance value is 0.000 (<0.005). This means that the independent variables consisting of *AI Application Utilization* ($_{X1}$) and Learning Innovation ($_{X2}$) simultaneously (together) have a positive and significant effect on the dependent variable, namely Academic Achievement (Y). This shows that the regression model in this study is truly acceptable and can be used for prediction.

t-test (Partial Test)

The t-test is used to determine whether *AI Application Utilization* ($_{X1}$) and Learning Innovation ($_{X2}$) partially have a significant effect on Academic Achievement (Y). The test uses a significance level of 0.05. The results of the t-test can be seen in the following table:

Table 6. Results of the t-test (Partial Test)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.375	2.936		2,512	.015
	LAG_X1	.122	.112	.132	1.090	.281
	LAG_X2	.621	.117	.643	5,323	.000

a. Dependent Variable: LAG_Y

Table 6 shows the explanation of each variable in the partial test as follows:

1. The $_{t\text{-value}}$ *for AI Application Utilization* is 1.090 and the $_{t\text{-table}}$ value is 2.002, meaning that $_{t\text{-value}}$ > $_{t\text{-table}}$, i.e., 1.090 < 2.002. The significance value *of AI Application Utilization* is 0.281 > 0.05. This means that the *AI Application Utilization* variable does not have a positive and significant partial effect on Student Academic Achievement. This is because, partially, the two independent variables do not have a significant effect on Student Academic Achievement. However, the positive direction of the relationship indicates that an increase in X tends to increase Y.
2. The $_{t\text{-value}}$ for Learning Innovation is 5.323 and the $_{t\text{-table}}$ value is 2.002, meaning that $_{t\text{-value}}$ > $_{t\text{-table}}$, i.e., 5.323 > 2.002. The significance value for Learning Innovation is 0.000 < 0.05. This means that the Learning Innovation variable partially has a positive and significant effect on Academic Achievement. The coefficient of 0.621 also indicates that X2 has the most dominant effect on Y compared to X1.

R^2Test (Coefficient of Determination Test)

The Coefficient of Determination (R2) essentially measures the extent to which the model is able to explain the variation in the dependent variable. The coefficient of determination value is between zero and one. A small R2 value means that the ability of the dependent variables is very limited. A value close to one means that the independent variables provide almost all the information needed to predict the variation in the dependent variable. The determination coefficient values can be seen in the following table:

Table 7. Coefficient of Determination Test

Model Summary[b]				
Model	R	R Square	Adjusted R-Square	Standard Error of the Estimate
1	.737[a]	.543	.527	2.83339

a. Predictors: (Constant), LAG_X2, LAG_X1

b. Dependent Variable: LAG_Y

Table 7 shows that the coefficient of determination test R^2 shows that the correlation or relationship (R) value is 0.737. From this output, the coefficient of determination (R^2) is 0.543, which means that the influence of the variables *of AI Application Utilization* (X1) and Learning Innovation (X2) on Academic Achievement (Y) is 45.7%, and the remaining 54.3% is influenced by other variables.

DISCUSSION

1. The Influence *of AI Application Utilization* (X1) on Academic Achievement (Y)

The influence of AI on academic achievement has been the focus of research in recent years. It shows that students who use AI technology in learning tend to have better academic achievement than those who do not use it (Marsithah et al., 2024). Based on the calculations and data analysis conducted by the researchers, the t-value for AI Application Utilization is 1.090 and the t-table value is 2.002, meaning that t-value > t-table, i.e., 1.090 < 2.002. The significance value of AI Application Utilization is 0.281 > 0.05. This means that the AI Application Utilization variable partially has no positive and significant effect on Student Academic Achievement. This is because, partially, the two independent variables have no significant effect on Student Academic Achievement.

This is because, partially, the two independent variables do not have a significant effect on Student Academic Achievement. However, the positive direction of the relationship indicates that an increase in X tends to increase Y. Similar research here refers to studies that find no significant effect or challenges in the use of AI on academic achievement. In line with these results, a previous study conducted by Irawan also emphasized that to optimize the potential of AI, adequate training and infrastructure support are needed. This shows that without a strong supporting ecosystem, the use of AI alone may not be enough to have a statistically significant impact. Meanwhile, dissimilar research refers to studies that find positive and significant effects or an increase in academic achievement through the use of AI. These results contradict

a study by Sudaryanto, which actually shows that students who use AI technology in learning tend to have better academic performance than those who do not use it.

2. The Effect of Learning Innovation (x_2) on Academic Achievement (Y)

Based on the calculations and data analysis conducted by the researcher, the t-value for Learning Innovation is 5.323 and the t-table value is 2.002, meaning that t-value > t-table, i.e., 5.323 > 2.002. The significance value of Learning Innovation is 0.000 < 0.05. This means that the Learning Innovation variable has a partial positive and significant effect on Academic Achievement. The coefficient of 0.621 also shows that X2 has the most dominant effect on Y compared to X1. Similar research here refers to studies that find positive and significant effects of learning innovation on academic achievement. The shift towards a learner-centered learning environment, which is the essence of learning innovation, has been proven to improve academic achievement because learning outcomes are not only assessed by test scores, but also by the ability to apply knowledge and solve problems. Meanwhile, dissimilar studies here refer to studies that find no significant effect or certain challenges in the implementation of learning innovation. The implementation of technology-based learning innovations, such as AI and deep learning, faces significant obstacles in remote areas that lack infrastructure such as stable internet connections and hardware. These challenges can negate the positive impact of innovation.

CONCLUSION

The conclusions of this study are as follows:

1. The independent variables consisting of *AI Application Utilization* (X_1) and Learning Innovation (X_2) simultaneously (together) have a positive and significant effect on the dependent variable, namely Academic Achievement (Y).
2. The variable *of AI Application Utilization* (X_1) partially has no positive and significant effect on Student Academic Achievement (Y). This is because partially, both independent variables do not have a significant effect on Student Academic Achievement. However, the positive direction of the relationship indicates that an increase in X tends to increase Y.
3. The Learning Innovation variable (X_2) partially has a positive and significant effect on Academic Achievement (Y).

The recommendations provided are as follows:

1. For Institutions: Immediately publish guidelines on the ethical use of AI in academia and improve the digital infrastructure that supports learning innovation.
2. For Lecturers: Continue to improve AI integration training and design assignments that encourage critical thinking (using AI as an analysis tool, not an answer).
3. For Students: Use AI as a critical learning assistant, not a shortcut, and improve digital literacy and self-management skills.

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