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The Influence of Artificial Intelligence, Learning Motivation, and Digital Literacy on the Learning Independence of Buddhist Students

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ABSTRACT

The development of Artificial Intelligence (AI) in education has transformed the way students acquire information and engage in the learning process. However, the use of AI that is not balanced with adequate learning motivation and digital literacy has the potential to affect students' learning autonomy. This study aims to analyze the influence of Artificial Intelligence, learning motivation, and digital literacy on the learning autonomy of Buddhist students in Bandar Lampung City. The study employs a quantitative approach using a survey method. The sample consists of 30 Buddhist students selected using purposive sampling. Data were collected via a questionnaire and analyzed using multiple linear regression with the aid of SPSS. The results indicate that Artificial Intelligence has a positive and significant effect on learning autonomy, contributing 87.6%, while digital literacy has a positive and significant effect, contributing 83.0%. Learning motivation has a positive relationship with learning autonomy and contributes 24%, but does not show a significant effect in the multiple regression model. Simultaneously, Artificial Intelligence, learning motivation, and digital literacy have a significant effect on learning autonomy, contributing 91.0%. The variable with the most dominant influence is Artificial Intelligence, followed by digital literacy. These findings indicate that enhancing students' learning autonomy in the digital age requires support through the judicious use of AI, the strengthening of digital literacy, and the development of learning strategies capable of fostering learning motivation. This study contributes to the development of technology-based education and self-directed learning in the digital age.

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Introduction

The development of digital technology in the Society 5.0 era has brought significant changes to various aspects of human life, including education. The integration of technology into the learning process has led to the emergence of learning systems that are

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more flexible, adaptive, and learner-centered. One of the most notable technological developments in recent years is Artificial Intelligence (AI). The presence of AI in education offers students various conveniences in accessing information, understanding course material, completing academic assignments, and supporting independent learning. AI-based technologies such as ChatGPT, Google Gemini, and various other smart learning platforms are increasingly being utilized by students as learning aids. The use of AI in education is considered capable of improving learning efficiency and supporting the development of students' independent learning skills (Ariyanti et al., 2025; Ghoreifi et al., 2024).

The use of AI in education has been on the rise since the acceleration of digital transformation following the COVID-19 pandemic. Schools, teachers, and students are required to adapt to digital learning systems that rely heavily on technology. AI can provide a more interactive, personalized, and flexible learning experience, thereby helping students solve various academic problems (Fatmayanti & Waskito, 2024). Furthermore, previous research indicates that the use of AI has a positive correlation with student motivation, as technology can create a more engaging and innovative learning environment (Dinata et al., 2025; Fauziyati, 2023). However, despite these benefits, the use of AI also presents new challenges in education, particularly regarding students' reliance on technology. Some students tend to use AI immediately without understanding critical thinking processes or delving deeply into the learning material. This situation can affect students' ability to learn independently.

Learning autonomy is one of the key competencies students must possess in the modern educational era. Learning autonomy refers to a student's ability to organize, manage, and evaluate their own learning process without excessive reliance on assistance from others (Oktafiani et al., 2024; Rohmah et al., 2023). Students with a high level of learning autonomy tend to be more proactive in seeking learning resources, disciplined in managing their time, responsible for their academic tasks, and able to adapt to changes in the learning system. Conversely, low learning autonomy can cause students to become passive and dependent on teacher assistance or technology to complete learning tasks. Therefore, strengthening learning autonomy is crucial in addressing the challenges of today's digital-based education. In addition to the use of AI, learning motivation is also a key factor influencing students' learning autonomy. Learning motivation refers to internal or external drives that inspire students to have the enthusiasm and desire to achieve learning goals. Students with high learning motivation tend to be more persistent, active, and responsible in the learning process. In the context of digital learning, learning motivation becomes even more important because students are expected to manage their learning activities independently. Previous research has shown that learning motivation has a significant influence on students' academic engagement and independent learning behavior (Oktafiani et al., 2024; Saputra, 2025; Setiawan et al., 2024). Factor that influences independent learning is digital literacy. Digital literacy is not only related the ability to use technological devices but also encompasses the ability to understand, evaluate, and utilize digital information critically and responsibly. Amid the development of AI and the rapid flow of digital information, students are required to possess strong digital literacy skills so they can utilize technology effectively and ethically in the learning process. Research shows that students with high levels of digital literacy tend to have better independent learning skills because they are able to search for, sort, and use digital information appropriately (Mulyadi & Afriansyah, 2022; Nasir & Wazithah, 2025).

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Buddhist students in Bandar Lampung are also experiencing this phenomenon of educational technology development. As part of the digital generation, these students utilize various technological devices and AI-based applications to support their learning activities. However, differences in levels of learning motivation, digital literacy skills, and patterns of AI use can influence students' levels of independent learning (Mulyadi & Afriansyah, 2022; Saputra, 2025). Some students use AI to broaden their horizons and deepen their understanding of learning materials, while others tend to rely on AI to instantly complete assignments without gaining a deep understanding of the material. This situation highlights the importance of research on the influence of AI use, learning motivation, and digital literacy on the learning autonomy of Buddhist students (Sati et al., 2023).

Previous research has extensively examined the relationship between AI use, digital literacy, and student learning outcomes in the general educational context. Some studies have focused on the impact of AI on learning motivation and instructional effectiveness, while others have examined the relationship between digital literacy and students' learning autonomy. However, there is still very little research that simultaneously examines the effects of Artificial Intelligence use, learning motivation, and digital literacy on students' learning autonomy. Furthermore, studies specifically examining Buddhist students as research subjects remain very limited, particularly in Bandar Lampung City. Most previous studies were conducted on college students or students with a general educational background without highlighting a specific religious educational context.

Therefore, this study focuses on the influence of the use of Artificial Intelligence, learning motivation, and digital literacy on the learning autonomy of Buddhist students in Bandar Lampung City. The novelty of this study lies in its focus on Buddhist students as a specific educational community and the integration of three contemporary variables namely, the use of Artificial Intelligence, learning motivation, and digital literacy in explaining students' learning autonomy behaviors. This study is expected to provide a theoretical contribution to the development of technology-based education and digital learning studies. Furthermore, the results of this study are expected to serve as input for teachers, schools, parents, and educational institutions in designing learning strategies capable of enhancing students' learning autonomy in the digital age.

The objectives of this study are: (1) to analyze the influence of the use of Artificial Intelligence on students' independent learning; (2) to analyze the influence of learning motivation on students' independent learning; (3) to analyze the effect of digital literacy on students' learning autonomy; and (4) to analyze the simultaneous effect of the use of Artificial Intelligence, learning motivation, and digital literacy on the learning autonomy of Buddhist students in Bandar Lampung City.

Method

1. Research Design

This study employs a quantitative approach using a survey method. The quantitative approach was chosen because this study aims to objectively test the effects of the variables Artificial Intelligence, learning motivation, and digital literacy on the learning autonomy of Buddhist students through statistical analysis. The survey method was used to collect empirical data from respondents by distributing a questionnaire as the research instrument. This study falls under the category of correlational research with an ex post

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facto design because the independent variables in the study were not directly manipulated by the researcher but were observed based on conditions that had already occurred among the study respondents.

The independent variables in this study consist of Artificial Intelligence (X_1), learning motivation (X_2), and digital literacy (X_3), while the dependent variable is students' learning autonomy (Y). This study was conducted to determine the effect of each independent variable, both partially and simultaneously, on the dependent variable. A quantitative approach with a correlational design was deemed appropriate to explain the relationships between variables in a measurable and systematic manner. This approach enables the researcher to quantify the strength and direction of the relationships among the variables using statistical analysis. Furthermore, the findings are expected to provide empirical evidence regarding the contribution of Artificial Intelligence, learning motivation, and digital literacy to the development of students' learning autonomy.

2. Participants

The population in this study consists of all Buddhist students in Bandar Lampung who are currently enrolled in high school (SMA) or vocational high school (SMK) or equivalent. This study employed purposive sampling to determine the research sample. Purposive sampling was chosen because the researcher established specific criteria for respondents deemed relevant to the study's objectives, namely Buddhist students who actively use digital technology and have previously utilized Artificial Intelligence in their learning activities.

The sample size was determined based on the requirements of multiple linear regression analysis. The study respondents consisted of Buddhist students from several schools in Bandar Lampung who voluntarily agreed to complete the research instrument. Before data collection began, the researcher first obtained permission from school administrators and explained the study's objectives to the respondents. All respondent data was kept confidential and used solely for academic purposes.

3. Data Collection

The data collection technique in this study used a questionnaire designed based on the indicators of each research variable. The research instrument employed a five-point Likert scale, ranging from "strongly disagree" to "strongly agree." The Artificial Intelligence variable was measured through the indicators of intensity of AI use, ease of AI use, and utilization of AI in the learning process. The learning motivation variable was measured using indicators of learning perseverance, interest in learning, enthusiasm for learning, and academic achievement orientation. The digital literacy variable was measured using indicators of the ability to use digital technology, the ability to evaluate digital information, and the ability to use digital media responsibly. The learning autonomy variable was measured using indicators of the ability to manage study time, responsibility for learning, initiative in learning, and the ability to complete tasks independently.

The research instruments were first tested for validity and reliability before being used in data collection. Validity was tested using Pearson's product-moment correlation, while reliability was tested using Cronbach's Alpha. The instruments were deemed suitable for use if they met the predetermined validity and reliability thresholds. Data collection was conducted both in person and via digital media using an online form to make it easier for respondents to complete the research questionnaire.

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4. Data Analysis

The research data were analyzed using descriptive and inferential statistical techniques with the aid of the Statistical Package for the Social Sciences (SPSS). Descriptive statistical analysis was used to describe the characteristics of the research data, including the mean, percentage, standard deviation, and distribution of respondents' answers for each research variable. Subsequently, inferential statistical analysis was used to test the research hypotheses.

Before conducting multiple linear regression analysis, the research data was first tested using prerequisite analysis tests, which included tests for normality, linearity, multicollinearity, and heteroscedasticity. Once all prerequisites were met, multiple linear regression analysis was performed to determine the effects of Artificial Intelligence, learning motivation, and digital literacy on the learning autonomy of Buddhist students, both partially and simultaneously. Hypothesis testing was conducted using the t-test to determine the partial effects of each independent variable and the F-test to determine the simultaneous effects of all independent variables on the dependent variable. The significance level used in this study was 0.05.

The results of the data analysis were then interpreted to explain the relationships among the study variables and to provide an overview of the effects of the use of Artificial Intelligence, learning motivation, and digital literacy on the learning autonomy of Buddhist students in Bandar Lampung City.

5. Research Constellation Model

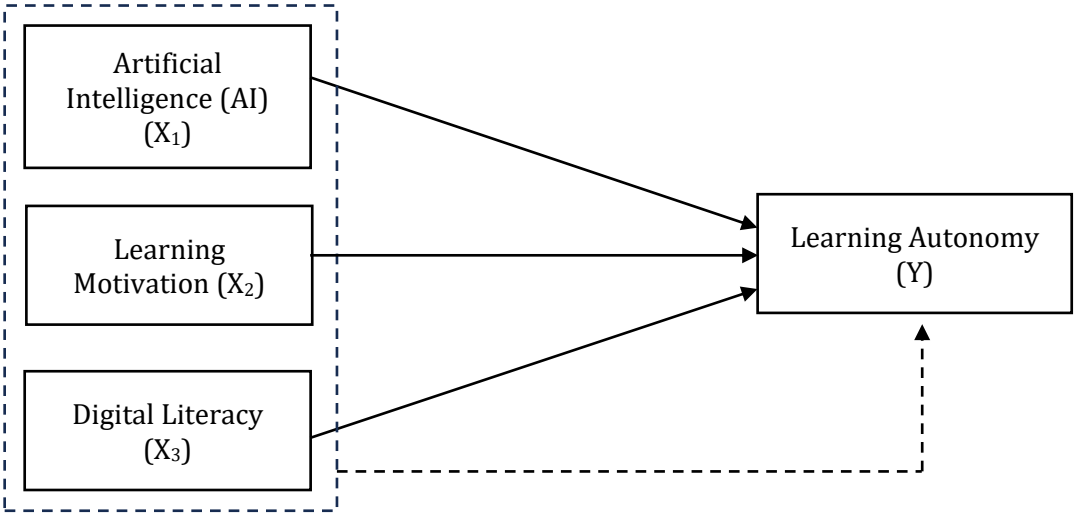

Figure 1. Research Constellation Model

Findings

Classical Assumption Test

Validity Test

The instrument validity test was conducted by correlating the score of each statement item with the total score using the *Pearson Product-Moment correlation* technique. Based on a

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pilot study of 30 respondents at a 5% significance level, the $_{table}$r-value obtained was 0.361. The analysis results showed that out of the 100 items tested, 89 items had a $_{calculated}$ r$_{-value}$> 0.361 and a p-value < 0.05, and were therefore deemed valid. Meanwhile, 11 other items (numbers 5, 7, 15, 26, 44, 48, 59, 66, 72, 81, and 89) were deemed invalid because $_{their\ calculated}$r$_{-values}$were less than 0.361. Consequently, these invalid items were excluded and not used in the data collection process.

Instrument Reliability Test

1. Reliability Test of the Artificial Intelligence (AI) Instrument

The research instrument in this study was tested using *Cronbach's Alpha*. As a basis for decision-making, an instrument is considered reliable and suitable for use in research if the *Cronbach's Alpha* value obtained is greater than the minimum threshold of 0.70.

Table 1. Reliability Test for Artificial Intelligence (AI)

Reliability Statistics	
Cronbach's Alpha	Number of Items
.745	23

Source: Data Analysis Results, 2026

Based on the results of the reliability test for the Artificial Intelligence (AI) instrument, a Cronbach's Alpha value of 0.745 was obtained with a total of 23 items. This Cronbach's Alpha value is greater than the minimum reliability threshold of 0.70; therefore, it can be concluded that the Artificial Intelligence (AI) instrument has a good level of reliability and is capable of providing consistent measurement results. Thus, all items in the Artificial Intelligence (AI) instrument are deemed reliable and suitable for use as a data collection instrument in this study.

2. Reliability Test of the Learning Motivation Instrument (x_2)

Table 2. Reliability Test of the Artificial Intelligence (AI) Instrument

Reliability Statistics	
Cronbach's Alpha	N of Items
.754	23

Source: Data Analysis Results, 2026

Based on the results of the reliability test of the Learning Motivation instrument, a Cronbach's Alpha value of 0.754 was obtained with a total of 23 items. This Cronbach's Alpha value is greater than the minimum threshold used in this study, which is 0.70; therefore, it can be concluded that the Learning Motivation instrument has a good level of reliability and is consistent in measuring the variables under study. Thus, all items in the Learning Motivation instrument are deemed reliable and suitable for use as a data collection tool in this study. The obtained reliability coefficient indicates that the instrument demonstrates satisfactory internal consistency, suggesting that the items measure the same underlying construct of learning motivation. Consequently, the instrument is expected to produce stable and dependable data, thereby enhancing the credibility and accuracy of the research findings. These results confirm that the instrument is appropriate for subsequent statistical analyses, including correlation and multiple regression testing.

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3. Reliability Test of the Digital Literacy Instrument

Table 3. Reliability Test of the Digital Literacy Instrument

Reliability Statistics	
Cronbach's Alpha	N of Items
.762	23

Source: Data analysis results, 2026

Based on the results of the reliability test for the Digital Literacy instrument, a Cronbach's Alpha value of 0.762 was obtained with a total of 23 items. This Cronbach's Alpha value is greater than the minimum threshold of 0.70, so it can be concluded that the digital literacy instrument has a good and consistent level of reliability. Thus, all items in the instrument are suitable for use as a data collection tool in research because they are capable of providing relatively stable and reliable measurement results.

4. Reliability Test of the Independent Learning Instrument

Table 4. Reliability Test for Artificial Intelligence (AI)

Reliability Statistics	
Cronbach's Alpha	N of Items
.754	24

Source: Data analysis results, 2026

Based on the results of the reliability test for the Learning Independence instrument, a Cronbach's Alpha value of 0.754 was obtained with a total of 24 items. This Cronbach's Alpha value is greater than the minimum criterion of 0.70, so it can be concluded that the Learning Independence instrument has a good level of reliability. Thus, all items in the instrument are deemed consistent and can be used as a data collection tool capable of producing reliable measurements in research.

Normality Test

Table 5. Normality Test

One-Sample Kolmogorov-Smirnov Test					
		AI	Learning Motivation	Digital Literacy	Learning Independence
N		30	30	30	30
Normal Parameters [a, b]	Mean	74.67	74.80	70.73	72.83
	Standard Deviation	13.644	14.411	21.507	18.377
Most Extreme Differences	Absolute	.085	.084	.125	.089
	Positive	.081	.065	.125	.089
	Negative	-.085	-.084	-.083	-.075
Test Statistic		.085	.084	.125	.089
Asympt. Sig. (2-tailed)		.200[c,d]	.200[c,d]	.200[c,d]	.200[c,d]

a. The test distribution is normal.

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b. Calculated from the data.
c. Lilliefors significance correction.
d. This is a lower bound of the true significance.
Source: Data analysis results, 2026

Based on the results of the normality test using the One-Sample Kolmogorov-Smirnov Test, it was found that the sample size for this study was 30 respondents for each variable, namely Artificial Intelligence (AI), Learning Motivation, Digital Literacy, and Learning Independence. The test results show that the Asymp. Sig. (2- -tailed) value for all variables is 0.200, which is greater than the significance level of 0.05 (0.200 > 0.05). Thus, the data for the variables AI, Learning Motivation, Digital Literacy, and Learning Autonomy are normally distributed. Therefore, it can be concluded that the research data meet the assumption of normality and are suitable for parametric statistical analysis in the next testing stage.

Linearity Test

Table 6. Linearity Test Using ANOVA

ANOVA Table

				Sum of Squares	df	Mean Square	F	Sig.
Independent Learning Artificial Intelligence	*	Between Groups	(Combined)	9,728.667	23	422,986	38,747	.000
			Linearity	8,575.998	1	8,575.998	785.588	.000
			Deviation from Linearity	1,152.669	22	52,394	4,799	.030
		Within Groups		65,500	6	10,917		
		Total		9,794,167	29			

Source: Data analysis results, 2026

Based on the results of the linearity test using the ANOVA test, it was found that the relationship between the Artificial Intelligence (AI) variable and Learning Independence showed a significance value in the Linearity section of 0.000, which is smaller than the significance level of 0.05 (0.000 < 0.05). This indicates that there is a significant linear relationship between the AI variable and Learning Independence. Furthermore, the F-value for linearity of 785.588 indicates a very strong linear relationship between the two variables. Thus, it can be concluded that the relationship between Artificial Intelligence and Learning Autonomy satisfies the assumption of linearity, allowing for further statistical analysis such as regression analysis.

Table 7. Linearity Test for Learning Autonomy and Learning Motivation

ANOVA Table

				Sum of Squares	df	Mean Square	F	Sig.
Learning Autonomy Learning Motivation	Between *Groups	(Combined)		8205.917	19	431,890	2,719	.054
		Linearity		2,354.844	1	2,354.844	14.827	.003
		Deviation from Linearity		5,851.072	18	325,060	2,047	.124
	Within Groups			1,588,250	10	158,825		
	Total			9,794.167	29			

Source: Data analysis results, 2026

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Based on the results of the linearity test using the ANOVA test, it was found that the relationship between the variables of Learning Motivation and Learning Autonomy had a significance value in the Linearity section of 0.003, which is smaller than the significance level of 0.05 (0.003 < 0.05). This indicates that there is a significant linear relationship between Learning Motivation and Learning Autonomy. Furthermore, the significance value for the "Deviation from Linearity" component was 0.124, which is greater than 0.05 (0.124 > 0.05), indicating that there is no significant deviation from a linear relationship. Thus, it can be concluded that the relationship between the variables Learning Motivation and Learning Autonomy meets the assumption of linearity and is therefore suitable for further analysis using regression or other parametric statistical methods.

Table 8 Linearity Test for Learning Autonomy and Digital Literacy

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Independent Learning * Digital Literacy	Between Groups	(Combined)	9,251.833	22	420,538	5,428	.014
		Linearity	8,128.037	1	8,128.037	104,910	.000
		Deviation from Linearity	1,123.796	21	53,514	.691	.761
	Within Groups		542,333	7	77,476		
	Total		9,794,167	29			

Source: Data analysis results, 2026

Based on the results of the linearity test using the ANOVA test, it was found that the relationship between the Digital Literacy variable and Learning Independence has a significance value in the Linearity section of 0.000, which is smaller than the significance level of 0.05 (0.000 < 0.05). This indicates that there is a significant linear relationship between Digital Literacy and Learning Independence. Furthermore, the significance value for the "Deviation from Linearity" section is 0.761, which is greater than 0.05 (0.761 > 0.05), indicating that there is no significant deviation from this linear relationship. Thus, it can be concluded that the relationship between the Digital Literacy and Learning Independence variables meets the assumption of linearity and can therefore be used for further statistical analysis, such as regression analysis.

Multicollinearity Test

Table 9. Multicollinearity Test

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	-10.444	6.978		-1,497	.147		
	Artificial Intelligence	.783	.249	.581	3,144	.004	.102	9,836
	Motivation Learn	to.011	.118	.009	.095	.925	.405	2,468
	Digital Literacy	.339	.132	.397	2,577	.016	.146	6,828

a. Dependent Variable: Independent Learning
Source: Data analysis results, 2026

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Based on the results of the multiple linear regression analysis in the Coefficients table, it was found that the Artificial Intelligence variable has a regression coefficient of 0.783 with a significance value of 0.004 (<0.05); thus, it can be concluded that Artificial Intelligence has a positive and significant effect on Learning Independence. This indicates that the better the utilization of Artificial Intelligence, the higher the level of students' learning autonomy. The Learning Motivation variable has a coefficient of 0.011 with a significance value of 0.925 (>0.05), so it does not have a significant effect on learning autonomy. Meanwhile, the Digital Literacy variable has a coefficient of 0.339 with a significance value of 0.016 (<0.05), indicating a positive and significant effect on learning autonomy. Based on the Standardized Coefficients (Beta) values, the Artificial Intelligence variable has the most dominant influence on learning autonomy with a Beta value of 0.581, compared to Digital Literacy at 0.397 and Learning Motivation at 0.009. However, the multicollinearity test indicated a fairly strong relationship among the independent variables, particularly for Artificial Intelligence (VIF = 9.836) and Digital Literacy (VIF = 6.828), although the tolerance values for both remained above 0.10.

Heteroscedasticity Test

Table 10 Heteroscedasticity Test

Correlations						
			AbsRes	Artificial Intelligence	Learning Motivation	Digital Literacy
Spearman's rho	AbsRes	Correlation Coefficient	1.000	-.200	.126	-.206
		Sig. (2-tailed)	.	.288	.506	.274
		N	30	30	30	30
	Artificial Intelligence	Correlation Coefficient	-.200	1.000	.589**	.854**
		Sig. (2-tailed)	.288	.	.001	.000
		N	30	30	30	30
	Motivation to Learn	Correlation Coefficient	.126	.589**	1.000	.264
		Sig. (2-tailed)	.506	.001	.	.159
		N	30	30	30	30
	Digital Literacy	Correlation Coefficient	-.206	.854**	.264	1.000
		Sig. (2-tailed)	.274	.000	.159	.
		N	30	30	30	30

**. The correlation is significant at the 0.01 level (two-tailed).
Source: Data analysis results, 2026

Based on the results of the heteroscedasticity test using Spearman's rho correlation, it was found that all independent variables had significance values greater than 0.05, namely Artificial Intelligence at 0.288, Learning Motivation at 0.506, and Digital Literacy at 0.274. Thus, it can be concluded that the regression model is free from the problem of heteroscedasticity. The residual variance in the model is relatively constant

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(homoscedastic), so one of the classical assumptions in regression analysis has been met.

Multiple Linear Regression Analysis

1. Partial Regression Test of Artificial Intelligence (AI) X_1 on Independent Learning (Y)

Table 11. Model Summary

Model Summary[b]				
Model	R	R-Square	Adjusted R-Square	Standard Error of the Estimate
1	.936[a]	.876	,871	6,596

a. Predictors: (Constant), Artificial Intelligence
b. Dependent Variable: Independent Learning
Source: Data analysis results, 2026

Based on the results of the partial regression test of Artificial Intelligence (AI) (X_1) on Learning Independence (Y) in the *Model Summary* table, a correlation coefficient (R) value of 0.936 was obtained. This value indicates that there is a very strong and positive relationship between Artificial Intelligence and Learning Independence. The R-squared (R^2) value of 0.876 indicates that Artificial Intelligence accounts for 87.6% of the variation in Learning Independence, while the remaining 12.4% is influenced by other factors outside the research model. Furthermore, the Adjusted R-Square value of 0.871 indicates that after adjusting for the sample size and variables in the model, Artificial Intelligence's ability to explain changes in Learning Autonomy remains at 87.1%. Meanwhile, the Standard Error of the Estimate value of 6.596 indicates the level of prediction error in the regression model; the smaller this value, the better the model's ability to predict the Learning Autonomy variable. Thus, it can be concluded that the Artificial Intelligence variable has a very strong relationship and predictive power regarding Learning Autonomy, meaning the constructed regression model has a high level of accuracy.

2. Partial Regression Test of Learning Motivation (X_2) on Learning Independence (Y)

Table 12. Model Summary

Model Summary[b]				
Model	R	R-Square	Adjusted R-Square	Standard Error of the Estimate
1	.490[a]	.240	.213	16,300

a. Predictors: (Constant), Learning Motivation
b. Dependent Variable: Learning Independence
Source: Data analysis results, 2026

Based on the results of the partial regression test between Learning Motivation (X_2) and Learning Independence (Y) in the *Model Summary* table, a correlation coefficient (R) value of 0.490 was obtained, indicating a positive relationship with a moderate level of between learning motivation and learning independence. The R-squared (R^2) value of 0.240 indicates that the learning motivation variable explains 24.0% of the variation in learning autonomy, while the remaining 76.0% is influenced by other variables outside the research model. Meanwhile, the Adjusted R-Square value of 0.213 indicates that after adjusting for the sample size and variables in the model, the effective contribution of learning motivation to

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learning autonomy is 21.3%. The Standard Error of the Estimate value of 16.300 indicates the level of prediction error in the regression model when estimating learning autonomy; the smaller this value, the better the model's predictive ability.

3. Partial Regression Test of Digital Literacy (X_3) on Learning Autonomy (Y)

Table 13. Model Summary

Model Summary[b]				
Model	R	R-Square	Adjusted R-Square	Standard Error of the Estimate
1	.911[a]	.830	.824	7.714

a. Predictors: (Constant), Digital Literacy
b. Dependent Variable: Learning Independence
Source: Data analysis results, 2026

Based on the results of the partial regression test of Digital Literacy (X_3) on Learning Independence (Y) in the *Model Summary* table, a correlation coefficient (R) value of 0.911 was obtained. This value indicates that there is a very strong and positive relationship between Digital Literacy and Learning Independence. The R-squared (R^2) value of 0.830 indicates that the Digital Literacy variable accounts for 83.0% of the variation in Learning Independence, while the remaining 17.0% is influenced by other factors not included in the research model.

Furthermore, the Adjusted R-Square value of 0.824 indicates that after adjusting for the sample size and variables in the model, Digital Literacy's ability to explain Learning Autonomy remains high, at 82.4%. The Standard Error of the Estimate value of 7.714 indicates the level of prediction error in the regression model; the smaller this value, the better the model's ability to predict Learning Autonomy. Thus, it can be concluded that the Digital Literacy variable has a very strong relationship and predictive power regarding Learning Autonomy, making the resulting regression model reliable and suitable for use in research analysis.

4. Simultaneous Regression Test of Artificial Intelligence (AI) (X_1), Learning Motivation (X_2), and Digital Literacy (X_3) on Learning Autonomy (Y)

Table 14. Model Summary

Model Summary[b]				
Model	R	R-Square	Adjusted R-Square	Standard Error of the Estimate
1	.954[a]	.910	.899	5.833

a. Predictors: (Constant), Digital Literacy, Learning Motivation, Artificial Intelligence
b. Dependent Variable: Learning Independence
Source: Data analysis results, 2026

Based on the results of the simultaneous regression analysis of Artificial Intelligence (AI) (X_1), Learning Motivation (X_2), and Digital Literacy (X_3) on Learning Independence (Y) in the *Model Summary* table, a correlation coefficient (R) of 0.954 was obtained. This value indicates that there is a very strong and positive relationship among the variables Artificial Intelligence, Learning Motivation, and Digital Literacy with Learning Independence. The R-squared (R^2) value of 0.910 indicates that these three independent variables account for

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91.0% of the variation in Learning Autonomy, while the remaining 9.0% is influenced by other factors outside the research model that were not examined.

Furthermore, the Adjusted R-Square value of 0.899 indicates that after adjusting for the number of independent variables and the sample size, the model's ability to explain Learning Autonomy remains very high, at 89.9%. Meanwhile, the Standard Error of the Estimate value of 5.833 indicates the level of prediction error in the regression model; the smaller this value, the higher the model's predictive accuracy. Thus, it can be concluded that the variables Artificial Intelligence, Learning Motivation, and Digital Literacy simultaneously have a very strong relationship with and explanatory power over Learning Autonomy; therefore, the resulting regression model is considered good and suitable for testing the influence of these three variables on Learning Autonomy.

Table 15. Coefficients

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-10.444	6.978		-1.497	.147
	Artificial Intelligence	.783	.249	.581	3,144	.004
	Motivation to Learn	.011	.118	.009	.095	.925
	Digital Literacy	.339	.132	.397	2,577	.016
a. Dependent Variable: Independent Learning						

Source: data analysis results, 2026

Based on the results of the multiple linear regression analysis in the Coefficients table using the Unstandardized Coefficients (B) values, the following regression equation was obtained:

$$\mathbf{Y = -10.444 + 0.783X1 + 0.011X2 + 0.339X3}$$

Notes:
Y = Learning Independence
X_1 = Artificial Intelligence (AI)
X_2 = Learning Motivation
X_3 = Digital Literacy

Based on this regression equation, the constant value of -10.444 indicates that if the variables Artificial Intelligence (X_1), Learning Motivation (X_2), and Digital Literacy (X_3) are assumed to be zero, then the value of Learning Autonomy (Y) is predicted to be by -10.444. A negative constant value indicates the starting point of the regression model when all independent variables make no contribution to Learning Autonomy.

The regression coefficient for Artificial Intelligence (X_1) of 0.783 indicates that a one-unit increase in the use of Artificial Intelligence assuming the Learning Motivation and Digital Literacy variables remain constant will increase Learning Autonomy by 0.783 units. A positive coefficient value indicates a positive relationship between Artificial Intelligence and Learning Autonomy. The regression coefficient for Learning Motivation (X_2) of 0.011 indicates that a one-unit increase in Learning Motivation assuming the variables Artificial Intelligence and Digital Literacy remain constant will increase Learning Autonomy by 0.011 units. However, based on a significance value of 0.925 > 0.05, the effect of Learning

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Motivation on Learning Autonomy is not significant; thus, statistically, Learning Motivation has not been proven to have a significant effect on Learning Autonomy in this regression model. The regression coefficient for Digital Literacy (X_3) of 0.339 indicates that a one-unit increase in Digital Literacy, assuming the variables Artificial Intelligence and Learning Motivation remain constant, will increase Learning Autonomy by 0.339 units. The positive coefficient value and significance value of 0.016 < 0.05 indicate that Digital Literacy has a positive and significant effect on Learning Autonomy.

Based on the results of the multiple linear regression, it can be concluded that, individually, Artificial Intelligence (AI) and Digital Literacy have a positive and significant effect on Learning Autonomy, as shown by significance values of 0.004 and 0.016, respectively, which are less than 0.05. Meanwhile, Learning Motivation does not have a significant effect on Learning Autonomy because its significance value is 0.925, which is greater than 0.05. Among the three independent variables, Artificial Intelligence is the variable with the most dominant influence on Learning Autonomy, as it has the largest Standardized Beta Coefficient of 0.581, compared to Digital Literacy (β = 0.397) and Learning Motivation (β = 0.009).

Discussion

Partial Regression Test of Artificial Intelligence (AI) X_1 on Learning Autonomy (Y)

The findings of this study indicate that Artificial Intelligence (AI) plays a significant role in enhancing students' learning autonomy. These results address the research objective of determining the influence of Artificial Intelligence on learning autonomy. The use of AI in learning activities enables students to be more active in seeking learning resources, finding solutions to academic problems, devising learning strategies, and evaluating their own understanding. Thus, AI serves not only as a technological tool but also as a means of supporting more autonomous and student-centered learning.

Theoretically, these findings align with the *Self-Regulated Learning* theory proposed by Zimmerman Nasution et al. (2025), which states that learning autonomy is an individual's ability to control, manage, and evaluate their own learning process through cognitive, motivational, and behavioral aspects. Artificial Intelligence can support this process by providing rapid feedback, delivering learning materials tailored to students' needs, assisting with problem-solving, and facilitating access to various knowledge sources. Through these characteristics, AI is able to enhance students' ability to take initiative and assume responsibility for their own learning process.

The findings of this study are also supported by various previous studies showing that the application of Artificial Intelligence in education can improve the quality of learning, student engagement, critical thinking skills, and self-directed learning. AI-based technologies, such as *intelligent tutoring systems* and generative AI applications, enable students to have a more personalized, flexible, and adaptive learning experience. However, the use of AI in learning must also be balanced with digital literacy and critical thinking skills so that students do not merely rely on the results provided by AI but remain capable of analyzing, verifying, and reflecting on the information they receive.

Given research findings indicating that Artificial Intelligence makes a significant contribution to students' learning autonomy, the use of AI should be directed toward empowering students to become *lifelong learners*. Therefore, educational institutions and

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educators need to integrate AI into the learning process wisely and responsibly by developing learning strategies that foster creativity, critical thinking skills, and students' responsibility for their own learning process.

Based on this discussion, it can be concluded that Artificial Intelligence has a strong influence on the development of students' learning autonomy. The appropriate use of AI, supported by digital literacy and strong critical thinking skills, can create a more personalized, flexible, and student-centered learning environment, thereby supporting improvements in the quality of learning in the digital age.

Partial Regression Test of Learning Motivation (X_2) on Learning Autonomy (Y)

The findings of this study indicate that learning motivation contributes to the development of students' learning autonomy. Based on the results of the partial regression analysis, it was found that learning motivation accounts for 24% of the variation in learning autonomy, while the remaining 76% is influenced by other factors outside the variables under study. These findings indicate that learning motivation is one of the factors that plays a role in encouraging students to develop the ability to manage their learning process independently, although its influence does not fully determine learning autonomy.

Theoretically, these findings align with the theory of learning motivation proposed by Desnaranti (2021),which states that learning motivation is the overall driving force within learners that initiates learning activities, ensures the continuity of learning, and provides direction to learning activities so that learning objectives can be achieved. Students with high learning motivation tend to have an internal drive to set learning goals, actively seek sources of knowledge, overcome learning difficulties, and evaluate their learning achievements. These characteristics are an important part of learning autonomy, which emphasizes an individual's ability to control and direct their own learning process.

The findings of this study are also consistent with *Self-Determination Theory* developed by Prasetyo et al. (2025), which explains that motivation particularly intrinsic motivation is a key factor in encouraging individuals to engage in activities voluntarily, take responsibility, and demonstrate perseverance in achieving their goals. In the context of learning, students with high motivation will be more active in determining learning strategies, managing their time, and taking the initiative to seek out various learning resources without always relying on the educator's guidance.

The findings of this study are also supported by various previous studies indicating that learning motivation has a positive effect on learning autonomy. These studies explain that the higher a student's motivation, the greater their desire to learn independently, the more perseverance they demonstrate in completing tasks, and the more capable they are of taking responsibility for their learning process and outcomes. However, the contribution of learning motivation in this study was classified as moderate, indicating that learning autonomy is influenced not only by motivation but also by other factors such as self-regulation skills, learning environment support, digital literacy skills, learning strategies, and the use of technology in learning.

Based on this discussion, it can be concluded that learning motivation is one of the key factors in enhancing students' learning autonomy. The higher a student's learning motivation, the greater their tendency to manage, control, and take responsibility for their learning process. Therefore, efforts to enhance learning autonomy must be accompanied

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by learning strategies that foster learning motivation, whether through strengthening intrinsic motivation or providing a supportive learning environment.

Partial Regression Test of Digital Literacy (X_3) on Learning Autonomy (Y)

The findings of this study indicate that digital literacy makes a significant contribution to students' learning autonomy. Based on the results of the partial regression analysis, a coefficient of determination (R^2) of 0.830 was obtained, indicating that digital literacy explains 83% of the variation in students' learning autonomy, while the remaining 17% is influenced by other factors outside the variables under study. These findings indicate that students' ability to use, understand, evaluate, and utilize digital technology is a key factor in shaping independent learning behavior.

Theoretically, these findings align with the concept of digital literacy proposed by Ozturk (2018), which explains that digital literacy is not merely the ability to use technological devices but also the ability to effectively understand, manage, evaluate, and utilize information obtained through digital media. Students with a high level of digital literacy tend to be better able to independently search for various learning resources, select relevant and reliable information, and utilize technology as a means to expand their knowledge and complete academic assignments. These abilities play a crucial role in fostering independent learning in the era of technology-based education.

These research findings are further supported by the theory of *Self-Regulated Learning* proposed by Zimmerman (2002), which states that independent learning is characterized by an individual's ability to plan, organize, monitor, and evaluate their own learning process. In the context of digital learning, digital literacy provides students with the opportunity to manage their learning more flexibly through the use of various online learning resources, digital learning platforms, and information technology. With strong digital literacy skills, students become more confident in making learning decisions, developing learning strategies, and taking responsibility for achieving their learning goals.

The results of this study are also consistent with various previous studies showing that digital literacy has a positive effect on learning autonomy. These studies explain that students with high digital literacy skills are more likely to actively seek information, independently explore learning resources, evaluate the information they obtain, and utilize digital technology to enhance the effectiveness of the learning process . Nevertheless, digital literacy skills must be balanced with critical thinking skills, digital ethics, and information management skills so that the use of technology is not merely consumptive but supports the development of in-depth knowledge.

Based on this discussion, it can be concluded that digital literacy is a factor that has a very strong influence on students' learning autonomy. The higher a student's digital literacy skills, the greater their ability to organize, manage, and take responsibility for their own learning process. Therefore, the development of digital literacy must be a priority in higher education through the provision of technological facilities, the integration of digital-based learning, and the strengthening of students' ability to use technology critically, wisely, and responsibly.

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Simultaneous Regression Analysis of Artificial Intelligence (AI) (X_1), Learning Motivation (X_2), and Digital Literacy (X_3) on Learning Autonomy (Y)

The research results indicate that Artificial Intelligence (AI), learning motivation, and digital literacy collectively make a significant contribution to students' learning autonomy. These findings indicate that the development of learning autonomy in the era of digital education is not influenced by a single aspect but is the result of a combination of students' ability to utilize artificial intelligence-based technology, their internal drive to achieve learning goals, and their ability to effectively access, understand, evaluate, and use digital information.

Theoretically, these findings can be explained through the *Self-Regulated Learning* theory proposed by Supriyadi et al., (2022), which states that learning autonomy is an individual's ability to manage their learning process through planning, controlling, monitoring, and evaluating their learning activities. In this context, Artificial Intelligence serves as a tool that can provide adaptive learning support, offer rapid feedback, help students find relevant information sources, and facilitate the resolution of academic problems. On the other hand, learning motivation serves as an internal factor that drives students to demonstrate enthusiasm, perseverance, and responsibility in achieving their learning goals. Digital literacy, in turn, acts as a supporting competency that enables students to use technology and digital information critically, effectively, and responsibly. These three aspects complement one another in shaping self-directed learning behavior.

The results of this study align with various previous studies indicating that the use of Artificial Intelligence in learning can enhance a more personalized and flexible learning experience; learning motivation provides psychological encouragement that influences student engagement in the learning process; and digital literacy is an essential skill in supporting learning success in the era of digital transformation. The consistency of these findings indicates that students who possess the ability to use AI appropriately supported by high learning motivation and strong digital literacy skills tend to be better able to set learning goals, independently seek out learning resources, solve academic problems, and evaluate their learning outcomes.

Although these three variables make a very significant contribution to learning autonomy, there are still approximately 9% of other factors outside the research model that may influence students' learning autonomy. These factors may include self-regulation skills, learning strategies, the learning environment, social support, the role of instructors, educational facilities, and students' personal characteristics. Therefore, future research may consider additional variables to develop a more comprehensive model for explaining the factors that influence learning autonomy. Based on this discussion, it can be concluded that Artificial Intelligence (AI), learning motivation, and digital literacy are three key components that collectively contribute to enhancing students' learning autonomy. The integration of AI technology into learning must be balanced with efforts to strengthen learning motivation and improve digital literacy so that students can become independent, critical, and adaptive learners who are ready to face educational challenges in the digital age.

Conclusion

This study demonstrates that Artificial Intelligence (AI), learning motivation, and digital literacy play different roles in shaping students' learning autonomy. The findings reveal

that Artificial Intelligence and digital literacy significantly enhance students' learning autonomy, whereas learning motivation, although positively associated with learning autonomy, does not exert a significant influence when considered alongside the other variables. Collectively, these variables provide a strong explanation of students' learning autonomy, with Artificial Intelligence emerging as the most influential predictor. These findings contribute to the growing literature on technology-enhanced education by highlighting that learning autonomy in the digital era is increasingly influenced not only by students' internal characteristics but also by their ability to effectively and responsibly utilize AI technologies supported by strong digital literacy. This study therefore reinforces the view that Artificial Intelligence should be regarded as a pedagogical partner that supports student-centered and autonomous learning rather than merely a technological tool.

The findings have important implications for educational practice, suggesting that higher education institutions should integrate Artificial Intelligence and digital literacy into curriculum design and teaching strategies to foster students' independent learning capabilities. Lecturers should also encourage the ethical and critical use of AI while developing learning environments that strengthen students' digital competencies and lifelong learning skills. Despite these contributions, this study is limited by its cross-sectional design and the characteristics of the research sample, which may limit the generalizability of the findings. Future research is recommended to involve more diverse educational contexts, adopt longitudinal or experimental approaches, and incorporate additional variables, such as AI literacy, self-regulated learning, academic engagement, and institutional support, to provide a more comprehensive understanding of the factors influencing students' learning autonomy in AI-supported education.

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