The Influence of Artificial Intelligence (AI) and Learning Engagement on Student's Learning Autonomy in the Society 5.0 Era.

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Abstrak

Penelitian ini bertujuan menganalisis bagaimana pemanfaatan *Artificial Intelligence* (AI) dan *Learning Engagement* berdampak pada kemandirian belajar mahasiswa di era Society 5.0. Fokus masalah adalah bagaimana integrasi teknologi dan keterlibatan aktif mahasiswa dapat menumbuhkan kemandirian dalam belajar. Metode yang digunakan dalam penelitian ini adalah kuantitatif dengan data yang diperoleh melalui penyebaran kuesioner. Sampel penelitian terdiri dari 349 mahasiswa Fakultas Ekonomi dan Bisnis Universitas Negeri Padang yang bertindak sebagai responden. Analisis data dalam penelitian ini dilakukan menggunakan metode regresi linear berganda melalui *software* SPSS versi 26. Hasil studi mengonfirmasi adanya pengaruh positif dan signifikan dari penggunaan *Artificial Inteligence* dan *Learning Engagement* terhadap kemandirian belajar mahasiswa, baik secara simultan maupun parsial.

Kata Kunci: Kemandirian Belajar; Artificial Inteligence; Learning Engagement; Era Society 5.0

Abstract

This research aims to analyze how the utilization of Artificial Intelligence (AI) and Learning Engagement impacts student learning autonomy in the Society 5.0 era. The focus of the problem is how the integration of technology and active student involvement can foster independence in learning. The method used in this study is quantitative, with data obtained through the distribution of questionnaires. The research sample consisted of 349 students from the Faculty of Economics and Business, Universitas Negeri Padang, who acted as respondents. Data analysis in this research was conducted using multiple linear regression through SPSS version 26 software. The results of the study confirm a positive and significant influence of the use of Artificial Intelligence and Learning Engagement on student learning autonomy, both simultaneously and partially.

Keywords*:Self-Regulated Learning; Aritificial Inteligence; Learning Engagement; Society 5.0 Era*

Introduction

The Society 5.0 era has changed the paradigm of human relations with technology, where technology now plays an integrated role in various aspects of life. This shift fundamentally transformed the higher education sector, driving a shift away from conventional learning methods towards a more intelligent, personalized, and student-oriented learning ecosystem. As a result, mastery of digital literacy and the ability to learn independently are no longer an option, but an essential prerequisite for students to be able to answer the challenges of the changing times along with technological developments. Students are now required to be able to manage their learning proactively, adaptively, and continuously, a process that is increasingly made possible by the presence of intelligent technologies such as *Artificial Intelligence* (AI) (Zawacki-Richter et al., 2019)

In the face of the complexity of academic demands and rapid digital innovation, learning independence is a key competency. The capacity of students to autonomously plan, run, and evaluate their own learning activities is very crucial. (Geng et al., 2019)Independent students not only wait for instruction, but proactively seek knowledge, identify problems, and design solutions. However, there is a significant gap between this ideal potential and the reality on the ground. Based on initial observations on S1 students of the Faculty of Economics & Business, Padang State University, it shows that daily learning practices are not in line with the potential of available technology. It was found that students' levels of learning independence, particularly in higher metacognitive aspects such as strategic planning and technology-supported self-evaluation, are still not optimal. Many students seem proficient in using gadgets, but stutter when they have to use them to set long-term study strategies or reflect on their understanding critically.

One of the most transformative innovations in this ecosystem is *Artificial Intelligence* (AI), which offers tremendous potential for personalizing learning, providing instant feedback, and unlocking unlimited access to knowledge Utilizing (Holmes et al., 2019) *Artificial Intelligence* has been shown to have a positive impact on student independence by providing virtual assistants that are always available However, preliminary data from preliminary studies show that The use of (HS & S, 2024) *Artificial Intelligence* by students is still very limited. Its use tends to be transactional—such as looking for quick answers or translating texts and has not yet reached a transformative level, namely as a partner for monitoring learning progress and evaluating understanding in depth. The research conducted by explained that the application of (Syamsidar & Samsinar 2024) *Artificial Intelligence* in teaching and learning activities has a good influence on improving students' independent learning abilities, especially in completing lecture assignments independently. Students who are active in the learning process, whether through discussion, self-exploration, or interaction with technology, tend to have higher motivation in learning and are able to direct themselves in achieving academic goals. (Hollister et al., 2022)

In the context of the use of *Artificial Intelligence* technology in education, various studies have shown that *Artificial Intelligence* can be an effective tool in supporting student learning independence. The research conducted by found that learning that uses (Nuankaew et al., 2019)*Artificial Intelligence* can provide more flexible and adaptive learning conditions, allowing students to manage their own learning. In addition, research by highlights that in an online learning environment, a high level of student autonomy requires stronger self-regulation skills, so that (Torenbeek et al., 2023)*Artificial Intelligence* can play a role in providing the necessary support to increase student learning independence

A number of previous studies have shown that learning that supports students' independence has a positive impact on their academic achievement and *learning engagement* in the learning process. According to research conducted by , there is a positive correlation between technology acceptance and student learning independence. Students who have a high level of technology acceptance tend to be more active in managing their learning strategies independently. In addition, research by confirms that (Nuankaew et al., 2019)& (Romero et al., 2020) *Learning Engagement* has a role in encouraging students to be more independent in their learning.

In addition to the technological factor, *Learning Engagement* defined as the active involvement of students cognitively, emotionally, and behaviorally in the learning process—is also a key factor that cannot be ignored. Students with high levels of *engagement* tend to be more active, intrinsically motivated, and more independent in pursuing their academic goals(An et al., 2024). This involvement is the driving "engine" from within the student. Unfortunately, observation data also shows that the level of *student engagement* is still relatively low. This low engagement is seen in the emotional aspect (lack of enthusiasm and a sense of connection to the material) and the cognitive aspect (the tendency to study on the surface rather than doing in-depth analysis). This *Learning Engagement* includes cognitive, emotional, and behavioral aspects that affect how students manage their learning process independently. Students with high *Learning Engagement* are more active in exploring the material, discussing. Research shows a positive relationship between *Learning Engagement* and learning independence, where the higher *the Learning Engagement*, the more independent the student is. In addition, learning independence has a

significant effect on (Squirt et al., 2024) *student learning engagement*, with parental support as a reinforcing factor.(Tresnowati & Sunarto , 2022)

Based on this phenomenon, there is an urgency to examine how the use of *Artificial Intelligence* and *Learning Engagement* together affects student learning independence. This research is novelty by integrating these two factors of external facilitators (AI) and internal drivers (*engagement*) to understand their combined impact in the context of higher education in Indonesia, a context that is often underrepresented in the global literature. Based on this, this study is focused on analyzing: (1) the simultaneous influence of the use of *Artificial Intelligence* and *Learning Engagement* on learning independence; (2) the partial effect of the use of *Artificial Intelligence* on learning independence; and (3) the partial effect of *Learning Engagement* on learning independence.

Method

This study uses a quantitative methodology to investigate the presence of causal effects among the variables studied. The main focus is to test the hypothesis regarding the influence of independent variables, namely the Use of *Artificial Intelligence* and *Learning Engagement*, on dependent variables, namely Learning Independence. The choice of this quantitative method is in line with the view that this method is effective for researching specific samples or populations, where data is obtained through structured instruments and statistically analyzed. The research location is at the Faculty of Economics & Business, Padang State University, with a research period of June 2025. (Sugiyono , 2022)

This study targets all active S1 students at the Faculty of Economics and Business UNP for the January-June 2025 semester, totaling 2,725 people. The Slovin formula was applied to calculate the sample size in this study with an error tolerance of 5%, so that a sample of 349 respondents was obtained. The technique used to take the sample is *proportional random sampling*. This method was chosen so that each study program in the faculty is proportionally represented in the sample according to the number of students, so that the research results can be generalized to the entire faculty population.

To obtain primary data in this study, an instrument in the form of a questionnaire has been distributed directly to the respondents who have been determined. This research instrument was designed using a measurement method in the form of a Likert scale which provides five answer choices. This scale aims to capture and measure the perception and behavior of each respondent related to the variables studied. This research itself involves three main variables consisting of two independent variables (independent variables) and one dependent variable (bound variables). The independent variables are the Use of *Artificial Intelligence* (symbolized as X1) and *Learning Engagement* (symbolized as X2), while the dependent variables are Learning Independence (symbolized as Y). Each of these variables is measured through a series of specific statement items or indicators. These indicators are not compiled arbitrarily, but have been carefully developed and derived from theoretical and literature studies relevant to each variable.

To ensure the quality of the questionnaire before being used in primary data collection, a series of instrument quality tests have been carried out. This test includes a validity test with *the Corrected Item-Total Correlation* technique as well as a reliability test conducted using *Cronbach's Alpha technique*. Validity and reliability tests are carried out to ensure the feasibility of research instruments, namely to ensure that the measurement tools are accurate (valid) and consistent (reliable). To test the research hypothesis, data that have passed the validity and reliability test are processed using multiple linear regression methods. All statistical data analysis in this study was fully processed using SPSS Software version 26.

The following is an overview of the conceptual framework built on the previous explanations:
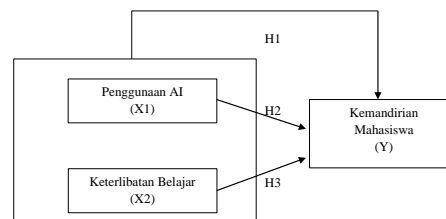

Figure 1. Conceptual Framework

RESULTS AND DISCUSSION

Respondent Characteristics

Demographic analysis of 349 respondents showed a fairly even distribution, In addition, the distribution of respondents across the seven departments within the Faculty of Economics and Business UNP was also proportional, ensuring that the sample reflected diversity in the faculty population.

Table 1. Respondent Characteristics by Department

No	Departemen	Sum	Percentage
1	Accountancy	60	17.24%
2	Economic Education	77	22.13%
3	Management	103	29.60%
4	Development Economics	73	20.98%
5	Digital Business	26	7.47%
6	Islamic Economics and Finance	3	0.86%
7	Sharia Business Management	7	2.01%
Sum		**349**	**100%**

Source : Primary Analysis Data 2025

The data in Table 1 shows that the Ministry of Islamic Economics and Finance has the lowest proportion of respondents, which is only 0.86% of the entire sample, or as many as 3 students.

Descriptive Analysis

Table 2. Overall Distribution Table of Research Variables

No	Variabel	Mean	TCR	Category
1	Learning Independence (Y)	3,23	64,69	Tall
2	*Artificial Inteligence* (X1)	3,03	60,56	Enough
3	*Learning Engagement* (X2)	1,85	37,10	Low

Source : Primary Analysis Data 2025

Based on table 2 above, the variable Learning Independence (Y) has an average of 3.23 with a

Respondent Achievement Rate (TCR) of 64.69%. This value is in the "High" category. It can be concluded from these results that students in the society 5.0 era have a relatively high level of learning independence, which means that most students perceptibly do not have good capabilities in managing their learning. This means they tend to struggle to take initiative, are irregular in scheduling, and lack responsibility for their own learning process, thus requiring constant external encouragement. Furthermore, for the *Artificial Intelligence* (X1) variable, an average of 1.90 was obtained with a TCR of 38.01%, which placed this variable in the "Low" category. These findings show that the level of utilization *of Artificial Intelligence* (AI) to support academic activities such as searching for information, writing assistance, or as virtual tutors is still relatively low among students. It is possible that students have not optimally used or are comfortable with the AI technology available for learning. Finally, the *Learning Engagement* (X2) variable showed an average value of 1.85 with a TCR of 37.10%, which is also included in the "Low" category. This illustrates that the level of involvement, participation, and enthusiasm of students in the overall learning process still needs to be improved. Students tend to be less active in discussions, do not show deep curiosity, and may feel less emotionally connected to the lecture material.

So it is concluded that most of the students in this study have shown a high level of learning independence. However, on the other hand, they still have a low level of *Artificial Intelligence* (AI) utilization and low *Learning Engagement* learning engagement in their academic process. This situation paints a contrasting picture: although students have good initiative and personal responsibility, they have not fully optimized modern technological tools (AI) and have not been actively and enthusiastically involved in the learning process.

Classic Assumption Test

To test hypotheses regarding the influence *of Artificial Intelligence* (AI) and *Learning Engagement* on learning independence, it is important to ensure that the data used meets the criteria of classical assumption tests. This prerequisite testing is a fundamental step before performing multiple linear regression analysis, either partially or simultaneously. The following is an explanation of the results of the classic assumption test processed using the SPSS version 26 application.

Table 3. Normality Test Results

		Unstandardized Residual
N		349
Normal Parameter	Mean	.0000000
	Hour Deviation	3.78570738
Most Extreme Differenc e	Absolute	.024
	Positive	.021
	Negative	-.024
Test Statistic		.024
Asymp. Sig. (2-tailed)		.200^{c,d}

Source : Primary Data (2025)

The normality test of the data carried out using the *Kolmogorov-Smirnov One-Sample* technique showed that the Asymp value was obtained. The sig (2-tailed) for residual is 0.200. The value met the criteria of normality because it was significantly greater than 0.05, which indicates that the research data was normally distributed.

Table 4. Multicollinearity Test Results

Model		Unstandardized		Standar	t	Itself.	Collinearity Statistics	
	Con	54.985	1.092		50.366	.000		
	X1	-.062	.018	-.175	-3.444	.001	1.000	1.000
	X2	-.132	.025	-.271	-5.321	.000	1.000	1.000
a. Dependent Variable: Learning Independence								

Source: Primary Data (2025)

It can be concluded that there was no multicollinearity between independent variables in this study. The conclusion is based on the results of the test where the *Artificial Intelligence* and *Learning Engagement variables* show a Tolerance value of 1,000 (> 0.1) and a VIF value of 1,000 (< 10). The low correlation between independent variables ensures that this regression model does not experience multicollinearity problems, so the results can be considered unbiased.

Table 5. Heterokedacity Test Results

Model		Unstandardized		Standardized	t	Itself .
		B	Std. Error	Beta		
1	Cons	.087	1.576		.055	.956
	X1	.044	.026	.090	1.675	.095
	X2	.032	.036	.047	.885	.377

Source : Primary Data (2025)

The results of the Heterokedasticity test show that the assumption of homogeneity in this regression model has been met. The significance values obtained for *the variables of artificial intelligence* (X1) and *learning engagement* (X2) were 0.095 and 0.377, respectively. Since the two values were statistically insignificant (p > 0.05), it can be concluded that there were no symptoms of heteroscedasticity. Thus, the validity of this regression model is guaranteed and the results are reliable.

Table 6. Results of Multiple Linear Regression Analysis Test

Model		Unstandardized		Standardized	t	Itself.
		B	Std. Error	Beta		
1	Cons	54.985	1.092		50.366	.000
	X1	.062	.018	.175	3.444	.001
	X2	.132	.025	.271	5.321	.000

Source : Primary Data (2025)

From the data on the table, it is known that the value of the constant is 54.985. The coefficient values that show the influence of each variable

are 0.062 for *Artificial Intelligence* (X1) and 0.132 for *Learning Engagement* (X2). All of these coefficients can be distributed into the multiple linear regression equation model below:

$$Y = 54{,}985 + +0{,}62x_1 0{,}132x_2$$

From this equation, it can be described as follows:

The constant value is 54.985, which means that without *artificial intelligence* and *learning engagement* , student learning independence is as high as 54.985. The *artificial intelligence* variable (X1) has a positive regression coefficient of 0.62. This means that if the use of *artificial intelligence* increases, students' learning independence will increase by 0.62. The *learning enact* variable (X1) had a positive regression coefficient of 0.62. This means that if the use of *artificial intelligence* increases, students' learning independence will increase by 0.62

So it can be interpreted that *artificial intelligence* has a positive influence on student learning independence. Where the higher the level of use *of artificial intelligence*, the student learning independence will also increase. Likewise with *learning engagement* where from the results obtained, in other words, the more students are actively involved in learning (*learning engagement*), the more independent they are in learning.

Test F

According to this test, the purpose of this test is to assess whether two or more independent variables together (simultaneously) exert a statistically significant influence on the dependent variable. If the significance value < 0.05 or F is calculated > F table, then there is a simultaneous effect.(Sugiyono, 2018)

Table 7. F Test Results

Model		Sum of Squares	df	Mean Square	F	Itself.
1	Regression	97,739	2	48,869	20,168	.000b
	Residual	838,380	346	2,423		
	Total	936,119	348			

Source : Primary Analysis Data 2025

Based on Table 7, the acceptance of the alternative hypothesis (Ha) is confirmed because the significance value of the test F (0.000) is lower than 0.05. This is evidence of the significant influence of *artificial intelligence* and *learning engagement* on the learning independence of FEB students of Padang State University in the era of society 5.0.

T Test

According to , the t-test is used to measure how much of an impact one independent variable has on a partially dependent variable. The individual influence of a variable is considered statistically significant if the t-value obtained exceeds the t-table value, or when the significance level is below 0.05.(Sugiyono, 2018)

Table 8. T Test Results

Model		Unstandard		Standard	t	Itself.
		B	Std. Error	Beta		
1	Const	54.985	1.092		50.366	.000
	X1	.062	.018	.175	3.444	.001
	X2	.132	.025	.271	5.321	.000

Source : Primary Analysis Data 2025

The analysis of the t-test (partial) proved that both independent variables significantly affected Learning Independence. The *Artificial Intelligence variable* was significant with a t-count value of 3.444 and a significance of 0.001 (< 0.05). Similarly, *Learning Engagement* was also proven to be significant with a t-count value of 5.321 and a significance of 0.000 (< 0.05). Thus, these two variables have been shown to have a significant partial influence.

Determinant Coefficient (R2)

The coefficient of determination (R²) serves to measure how much of the variation of a dependent variable is able to be explained by its independent variables. A value of R² that is closer to 1 indicates that independent variables have a stronger ability to explain variations in dependent variables.

Table 9. Determinant Coefficient (R2)

Model	R	R Square	Adjusted R Square	Std. Error

| 1 | .323a | 0,104 | 0,099 | 1,557 |

Source : Primary Analysis Data 2025

The results of the study show that *the variables of artificial intelligence* and *learning engagement* together contribute 10.4% to student learning independence in the era of society 5.0. This value is based on the result of the determination coefficient (R Square) of 0.104. Meanwhile, the remaining influence of 89.6% was explained by other variables outside the scope of this study.

Discussion

The Effect of the Use *of Artificial Intelligence* (AI) and *Learning Engagement* on Student Learning Independence in the Society 5.0 Era

The first hypothesis test (H1) showed that AI and *Learning Engagement* together significantly affect student learning independence. The acceptance of H1 is based on the results of the F test with a significance value of $0.000 < 0.05$. The determination coefficient (R Square) of 0.104 indicates that the simultaneous contribution of these two variables to learning independence is 10.4%. This figure shows that the combined contribution of *the Artificial Intelligence* and *learning engagement* variables is able to explain 10.4% of the changes that occur in the learning independence variable. This figure indicates that the 10.4% variation in students' learning independence can be explained by a combination of the use of *artificial intelligence* and their *level of learning engagement*. Meanwhile, the remaining 89.6% was influenced by other factors outside the scope of this study. Other factors can include metacognitive strategies, prior knowledge, instructional design, and interpersonal skills as suggested by These findings are in line with the conceptual framework that is built, where modern technologies such as AI and active student involvement in learning are the main drivers of the formation of independence in the era of Society 5.0. Students who are able to utilize (Sáiz -Manzanares et al., 2023)(Rashid &

Asghar, 2016)*Artificial Intelligence* to support their learning process and at the same time are actively involved (cognitive, emotional, and behavioral) in lectures, tend to be better able to manage, control, and take responsibility for their own learning.

The Effect of the Use of Artificial Intelligence (AI) on Student Independence in Learning.

Based on the t-test, the *Artificial Intelligence* (AI) variable has been proven to significantly and positively affect student learning independence. The acceptance of this second hypothesis (H2) is supported by a significance value of $0.001 < 0.05$. The magnitude of this influence is shown by a regression coefficient of 0.062, which means that every increase in the use of AI by one unit will encourage an increase in learning independence by 0.062 units. These results are in line with previous research by and which states that the use of (Cahyanto et al., 2024)(Murcahyanto , 2023)*Artificial Intelligence* has a positive impact on student independence. *Artificial Intelligence* provides flexible access to materials, instant feedback, and customizable learning, all of which are critical components in supporting independent learning. However, this finding is interesting This is in line with the results of a descriptive analysis that found that the level of use of *Artificial Intelligence* by students in general is still classified as "Adequate" (TCR 60.56%). Students are familiar enough with *Artificial Intelligence* to access information and help with writing, but its use is not optimal. This indicates that although the use of *Artificial Intelligence* has not been maximized, its impact on learning independence is significant. This strengthens the argument that *Artificial Intelligence* has great potential to promote independence, and if its utilization can be increased from "Sufficient" to "High" levels, then its influence on learning independence will also be stronger

The Influence *of Learning Engagement* on Student Independence in Learning

The t-test (partial test) for the Learning Engagement variable proved that there was a

positive and significant influence on student learning independence, so that the third hypothesis (H3) was accepted. These findings are based on a significance value of 0.000 (< 0.05). The regression coefficient value of 0.132 indicates that every increase in *learning engagement* will increase learning independence by 0.132 units. These findings are in line with research conducted and , which also found a significant positive association between (Hafsah et al., 2024)(Sutedjo et al., 2024)*learning engagement* and learning independence. Students who are truly engaged in learning will be more motivated to organize their own learning process, seek additional information, and complete assignments without waiting for direction from others. This condition becomes very relevant when viewed from the results of descriptive analysis which shows that the *level of student Learning Engagement* in general is in the "Low" category with a TCR of 37.10%. This low involvement can be seen in all aspects, both *skills, emotional, participation*, and *performance engagement*, all of which are in the "Low" category. The presence of significant influence despite the low level of engagement shows how crucial *the role of Learning Engagement* is. This implies that even the slightest increase in student engagement in learning will have a significant positive impact on their independence. Therefore, efforts to increase students' enthusiasm, participation, and emotional attachment in the academic process are very strategic to encourage independent learning in the Society 5.0 era.

CONCLUSION

The results of this study confirm the significant synergistic effect of *Artificial Intelligence* (AI) and *Learning Engagement* on student learning independence. Furthermore, both also showed positive and statistically significant independent contributions. This phenomenon can be explained through two dimensions: the external dimension, where *Artificial Intelligence* (AI) becomes a technological accelerator for learning autonomy, and the internal dimension, where *Learning Engagement* becomes the intrinsic motivational driver. The practical implication is the need to develop student capacity in these two domains: mastery of AI technology and increased involvement in the academic process. As a direction for future research, exploration of other relevant variables is highly recommended to gain a holistic understanding of the factors that shape learning independence.

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