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Artificial Intelligence (AI)-Based Digital Learning: The Impact on Students' Learning Motivation and Digital Literacy in Riau

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ABSTRACT

The rapid development of digital technology, particularly Artificial Intelligence (AI), has transformed educational practices and learning environments. This study investigates the impact of AI-based digital learning on student learning motivation and digital literacy in Riau. A quantitative research design was employed using a questionnaire administered to 45 students in Riau. Data were analyzed using Structural Equation Modeling (SEM) with Path Analysis (version 3.0) to examine the relationships between AI-based digital learning, learning motivation, and digital literacy. The findings reveal that AI-based digital learning does not have a statistically significant effect on student learning motivation (β = -0.607; T = 0.607 < 1.97; p = 0.544 > 0.05). In contrast, AI-based digital learning has a significant positive effect on students' digital literacy (β = 0.360; T = 3.047 > 1.97; p = 0.000 < 0.05). These results indicate that while AI integration enhances students' digital competencies, it does not necessarily foster their motivation to learn. The study suggests that AI-based learning should be complemented with interactive pedagogical strategies—such as collaborative learning, gamification, and reward-based approaches—to effectively enhance student motivation. Despite its limited influence on motivation, AI demonstrates substantial potential in improving digital literacy, enabling educators to promote advanced digital skills through smart learning applications, data-driven learning, and AI-supported platforms. These findings highlight the importance of balancing technological integration with pedagogical innovation to maximize learning outcomes.

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1. INTRODUCTION

Education can be conceptualized as a structured and purposeful learning process aimed at equipping learners with the knowledge, skills, and competencies necessary to strengthen human

capital and foster sustainable national development. Moreover, education plays a strategic role in cultivating social awareness and responsibility within society, particularly through structured initiatives such as Education and Technology Development programs (Florida et al., 2012; Liu & Qin, 2010; Sari, 2017). The rapid advancement of Artificial Intelligence enabled digital technologies within the framework of the Industrial Revolution 4.0 has become a pivotal catalyst for transformation across diverse sectors, including education. In Indonesia, education policies are expected to be in line with the Sustainable Development Goals (SDGs) as well as inclusive quality education. Furthermore, these efforts are in line with the Asta Cita mission of President Prabowo Subianto toward achieving Golden Indonesia 2045, which prioritizes the development of high-quality human resources through the enhancement of educational standards. Health and access to technology. especially Motivation and Digital Literacy (InnoVillage, 2024; Unnes, 2024). A survey in Riau Province shows that the Digital Literacy Index is still below the national figure, which is still at 3.3. below the national average of 3.54, and all parties must build a safer, healthier, and more intelligent digital space (GoRiau, 2025).

To face global challenges, of course, students must have high motivation to learn (Ritonga et al.. 2024). Learning motivation is the main key to the success of education. without good motivation. The learning process can feel boring, and learning will not go well (Rambe, 2022). Learning in the current era, especially in Artificial Intelligence (AI) digital learning. must be present as an innovative solution to increase learning motivation by providing a good. interesting learning experience and in accordance with the development of technological needs (Zuo et al., 2019). This technology allows students to feel more engaged. motivated. and excited about undergoing the learning process (Destia et al., 2024; Maharani et al., 2024). The results of the study show that AI Chat GPT learning media has a significant relationship with students' learning motivation. These results show that 84.9% of students feel more motivated in using AI Media (Leny, 2024; Muji Rahayu et al., 2025).

A growing body of empirical evidence suggests that the integration of Artificial Intelligence (AI) into learning applications fosters the emergence of creative and innovative pedagogical practices, which subsequently play a significant role in strengthening students' learning motivation (Hapsari et al.. 2024). The study concludes that there is a statistically significant positive relationship between the utilization of AI-based applications and students' learning motivation. The findings further revealed that the majority of students showed a relatively high level of motivation and engagement in learning (Amir & Ritonga, 2024). The utilization of AI in learning also increases students' motivation to learn. however. to utilize it properly, students must understand AI technology well (Syaukani et al.. 2024). Moreover, the integration of Artificial Intelligence (AI) has the potential to enhance students' learning motivation, Artificial Intelligence (AI) also plays an important role in improving digital literacy. both among students, educators, and the general public. AI plays an important role in improving digital literacy by providing a personalized and adaptive learning experience. AI allows for quick access to relevant information, accelerates comprehension, and helps individuals learn more efficiently. Technologies such as educational chatbots create interactive and engaging learning. increasing motivation to master digital skills (Hasudungan & Kurniawan, 2018; Siswanto et al., 2024). For educators, AI helps analyze student needs and improve teaching effectiveness. Overall. AI supports a more tech-savvy society, ready to face the digital world.

The results suggest that the integration of AI-based learning applications plays a meaningful role in strengthening digital literacy, particularly in studies centered on teachers as the primary research subjects. The analysis further demonstrates that teachers' digital literacy levels were classified within the moderate category (Lutfin et al., 2024). Research with student objects also suggests that there is a positive correlation between Artificial Intelligence and digital literacy (Zega & Batubara, 2024). The research also suggests that by using blended learning technology. Students can obtain digital ethics. information literacy and communication skills. This finding underscores the pivotal role of Artificial Intelligence (AI) in fostering students' capacity to become critical and responsible participants in the digital environment, while also equipping them with the competencies necessary to adapt to and anticipate developments in the digital era (Nabila et al., 2024; Sartika et al., 2024; Sitorus & David

Fadillah Murti, 2024). One of the ways to strengthen literacy skills by improving understanding and analysis of reading can be used for Artificial intelligence-based digital learning (Nadifa Tarigan & Aminah Hasibuan, 2023). In addition. AI is able to present a different learning experience and strengthen students' understanding of digital**.** This research aims to answer the question Does AI-based digital learning have a significant effect on student learning motivation? And how does AI-based digital learning affect students' digital literacy?

2. METHODS

This research employed a quantitative descriptive approach involving students from UIN Suska Riau and the IPTAR as the study population. The research subjects were students, and the study was conducted from June to August 2025. A total of 45 participants were selected as the sample using a purposive sampling technique. This sampling is based on the consideration that the student is active in the Artificial Intelligence-based learning process. The research instrument employed in this study was a questionnaire, consisting of a structured set of written items designed to obtain information from respondents regarding their characteristics, perceptions, or knowledge related to the variables under investigation (Arikunto, 2011). In this study, data on Artificial Intelligence (AI)–based digital learning and Learning Motivation were collected using a Likert-scale questionnaire with response categories ranging from Strongly Agree, Agree, Doubtful, Disagree, to Strongly Disagree. Meanwhile, Digital Literacy was measured using frequency-based response options, namely Very Often, Often, Sometimes, Rarely, and Never. Respondents were instructed to select the response option that best reflected their perceptions and experiences.

Data analysis was carried out with the help of SPSS SmartPLS. The Partial Least Square (PLS) method was chosen because it has advantages, including being able to test predictive models, being used even though the underlying theory is still weak, being able to overcome data with violations of classical assumptions (normality, multicollinearity, autocorrelation) and being suitable for relatively small sample sizes and constructs both formative and reflective (Abdillah, 2009). Therefore, PLS was considered appropriate for this study involving 45 samples, small samples can still be done if the indicator meets the reliability requirements (Kock & Hadaya, 2018). Furthermore, Structural Equation Modeling (SEM) focuses on the analysis of latent variables or latent constructs (Jogiyanto, 2009). Latent variables are abstract concepts that cannot be measured directly, but through indicators or observed variables. In Structural Equation Modeling (SEM), latent variables are categorized into two types: exogenous and endogenous variables. Exogenous variables consistently function as independent variables across all structural equations, whereas endogenous variables serve as dependent variables in at least one equation, although they may also act as independent variables in other parts of the model.

The Partial Least Squares (PLS) analysis in this study was conducted through a series of structured procedures. Initially, a theory-grounded structural model (inner model) was formulated to examine the hypothesized relationships between exogenous and endogenous constructs, as delineated in the conceptual framework. Subsequently, the specified theoretical model was operationalized into a path diagram to provide a systematic and explicit visualization of the interrelationships among the exogenous and endogenous variables. This research framework was formed from the relationship between the concept of Artificial Intelligence (AI)-assisted digital learning, learning motivation, and student digital literacy. Drawing upon Self-Determination Theory (SDT), learning motivation is conceptualized as emerging from the fulfillment of three fundamental psychological needs: autonomy, competence, and relatedness. Within this framework, the integration of Artificial Intelligence (AI) technologies in educational contexts holds substantial potential to support these needs by enabling personalized content delivery, providing automated and timely feedback, and facilitating adaptive digital interactions that enhance learner engagement. However, the success rate is greatly influenced by the learning design, the availability of infrastructure and the ability of students to use technology, so it is important to assess the influence of AI in the context of regions such as Riau which are strengthening their digital transformation. On the other hand. The theory of digital literacy emphasizes

that digital literacy includes the ability to find, assess, process, and utilize digital information ethically and appropriately. Frameworks such as the UNESCO Digital Literacy Framework, the Eshet-Alkalai Model. and DigComp mention that digital literacy is not only related to technical skills, but also critical thinking and digital ethics. AI-based learning requires students to interact directly with digital technology and assess AI-generated information. AI has the potential to make an important contribution to improving students' digital literacy and is described as follows:

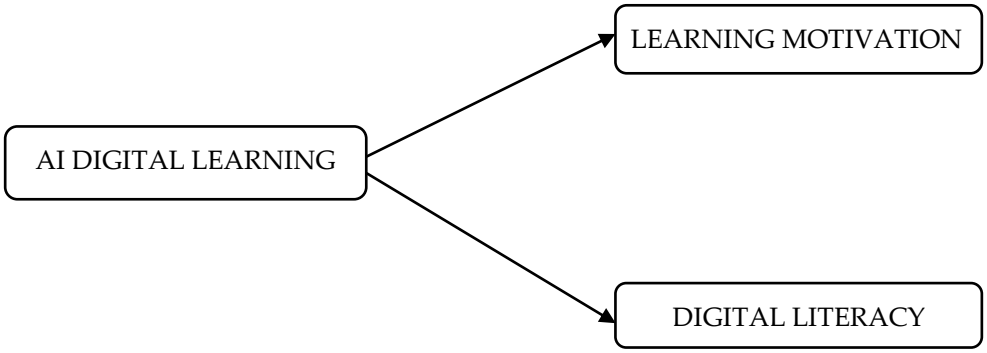

Figure 1. Conceptual Framework

3. FINDINGS AND DISCUSSION

Based on the data recapitulation, a total of 45 students participated in this study. The final sample size was determined through a verification process to ensure the completeness and validity of the responses collected by the researcher. The research findings are presented as follows:

Table 1. Research Respondents

Type of PT	College	Number of Students
PTN	UIN Suska Riau	28
PTS	IPTAR	17
Total		**45**

Source: Data processing (2025)

As shown in Table 1, the respondents in this study consisted of students from two higher education institutions in Riau, with the majority coming from UIN Suska Riau (28 students or 62.2%), while 17 students (37.8%) were from IPTAR. This distribution indicates that the sample represents both public and private higher education institutions, allowing the study to capture diverse perspectives on the implementation of AI-based digital learning. The inclusion of students from different institutional backgrounds strengthens the reliability of the findings and provides a broader understanding of how AI-based learning influences students' motivation and digital literacy.

3.1 Model Fit Evaluation

The assessment of the outer model, or measurement model, was performed using three primary criteria within the SmartPLS analytical framework: convergent validity, discriminant validity, and composite reliability. In the context of a reflective measurement model, convergent validity is evaluated by analyzing the strength of the correlations between individual indicator loadings and their corresponding latent constructs. A reflective indicator is considered adequate when it demonstrates a loading factor greater than 0.70 on the construct it is intended to measure. (Imam. 2008) said that for the initial stage of research. A loading value ranging from 0.50 to 0.60 is generally regarded as acceptable for measurement purposes. In this study, a loading factor threshold of 0.50 was applied. Based on the PLS analysis results presented in Table 2, the outer model evaluation shows that the

correlations between indicators and their respective constructs satisfy the requirements of convergent validity, as all loading factor values exceed 0.50.

Table 2. Outer Loading Indicator Model Value

	Digital Literacy	Learning Motivation	AI Digital Learning	Critical Values	Information
AI1			0.689	0.5	Valid
AI10			0.704	0.5	Valid
AI2			0.720	0.5	Valid
AI3			0.781	0.5	Valid
AI4			0.732	0.5	Valid
AI5			0.794	0.5	Valid
AI6			0.741	0.5	Valid
AI7			0.775	0.5	Valid
AI8			0.893	0.5	Valid
AI9			0.853	0.5	Valid
LD1	0.846			0.5	Valid
LD10	0.814			0.5	Valid
LD11	0.786			0.5	Valid
LD12	0.795			0.5	Valid
LD2	0.735			0.5	Valid
LD3	0.835			0.5	Valid
LD4	0.815			0.5	Valid
LD5	0.842			0.5	Valid
LD6	0.741			0.5	Valid
LD7	0.775			0.5	Valid
LD8	0.725			0.5	Valid
LD9	0.831			0.5	Valid
MB1		0.783		0.5	Valid
MB10		0.854		0.5	Valid
MB11		0.753		0.5	Valid
MB2		0.855		0.5	Valid
MB3		0.752		0.5	Valid
MB4		0.725		0.5	Valid
MB5		0.696		0.5	Valid
MB6		0.732		0.5	Valid
MB7		0.769		0.5	Valid
MB8		0.780		0.5	Valid
MB9		0.703		0.5	Valid

Source: Data processing (2025)

The table above presents the loading factor estimates for each construct associated with the variables in the model. The findings indicate that all constructs satisfy the recommended loading threshold, thereby meeting the criteria for construct validity. To further assess convergent validity, the Average Variance Extracted (AVE) was examined. A construct is considered to demonstrate adequate convergent validity when its AVE value exceeds 0.50, signifying that the latent variable accounts for more than 50% of the variance in its respective indicators. The AVE values obtained from the SmartPLS 3.0 analysis are presented as follows:

Table 3. Average Variance Extracted

	Composite Reliability	Mean Variance Extracted (AVE)
Digital Literacy	0.963	0.634
Learning Motivation	0.938	0.539
AI Digital Learning	0.936	0.595

Source: Data processing (2025)

Based on the results presented in the table, convergent validity was assessed through the examination of the Average Variance Extracted (AVE) values. The findings reveal that all latent constructs exhibited AVE values below the recommended threshold of 0.50. Nevertheless, each construct achieved composite reliability values exceeding 0.60. In light of these results, the constructs were retained and deemed acceptable in terms of measurement validity. This suggests that, despite the suboptimal AVE values, the indicators underlying the latent constructs demonstrate sufficient convergent validity when considered alongside their satisfactory composite reliability estimates.

3.2 Structural Model Testing

The structural model was analyzed to explore the relationships among the variables, along with their levels of significance and the coefficient of determination (R^2) within the proposed model. This evaluation included an examination of the R^2 values for the endogenous constructs and the application of t-statistics to assess the significance of the hypothesized path coefficients. The following section presents the structural model applied in this study.

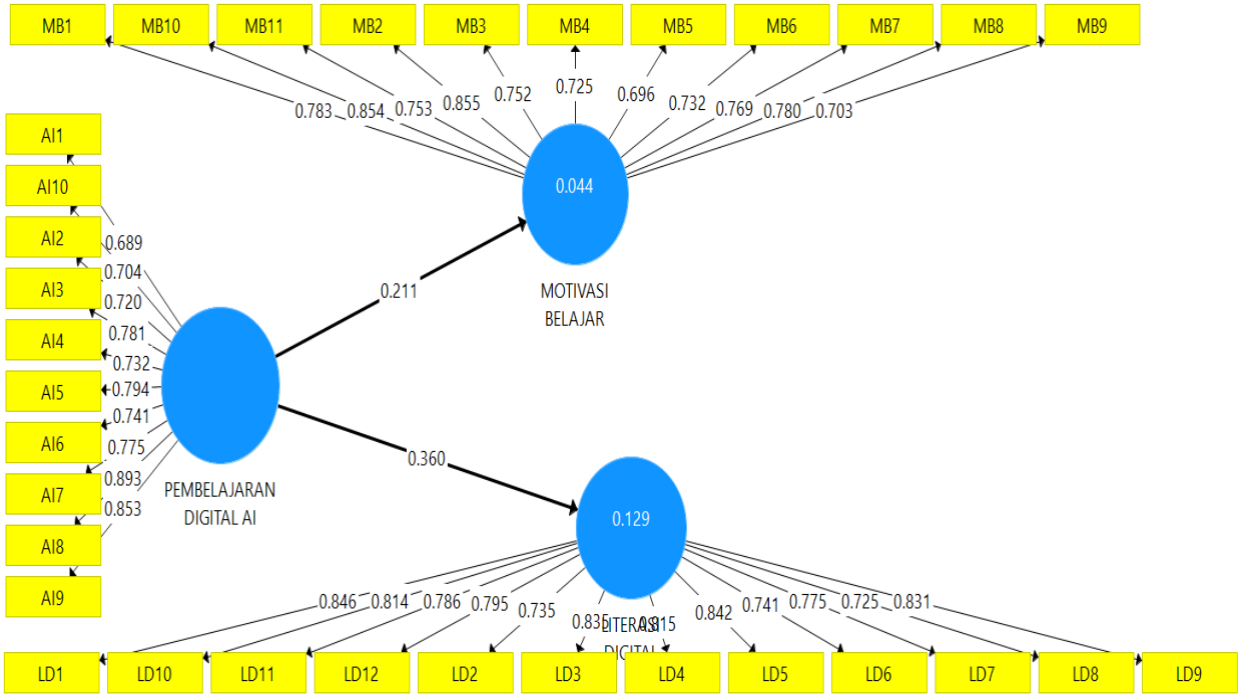

Figure 2. AI Digital Learning Structure Model. Learning Motivation and Digital Literacy
Source: Data Processing (2025)

Through the conceptual diagram above, it can be seen that the path model consists of one exogenous variable. namely Digital Learning. Artificial Intelligence. and endogenous variables. namely Digital Literacy and Student Learning Motivation. Furthermore, the model estimation procedure described above was conducted using the SmartPLS 3.0 application. The results indicate that variations

in AI Digital Learning account for 4.4% of the variance in Learning Motivation, while the remaining 95.6% is explained by other factors not included in the model. Additionally, AI Digital Learning contributes 12.9% to the variance in Digital Literacy, with the remaining 87.1% influenced by other variables that were not examined in this study. This indicates that the use of AI has little effect on encouraging student motivation; other factors, such as lecturer-student interaction, the internet, and other learning methods, may have a more dominant role. In the context of Riau, internet access may be the cause so that the use of AI is not optimal, so it becomes a burden on students.

3.3 Hypothesis Testing

The significance of the estimated parameters provides critical insights into the relationships among the variables under investigation. Hypothesis testing is conducted based on the inner model estimates reported in the output. The following table summarizes the results of the structural model assessment.

Table 4. The result of the value of the t-calculation coefficient

	Original Sampel (O)	Average Sampel (M)	Standard Deviation	T Statistic	P Values
AI DIGITAL LEARNING -> LEARNING MOTIVATION	0.211	0.177	0.347	0.607	**0.544**
DIGITAL LEARNING AI -> DIGITAL LITERACY	0.360	0.401	0.118	3.047	**0.002**

Source: Data Processing (2025)

Hypothesis Testing 1:

H1: *Digital Artificial Intelligence Learning* does not have a significant effect on *Student Learning Motivation*

Furthermore, based on the aforementioned hypothesis, hypothesis testing was conducted employing the *bootstrapping* procedure using software, from which the following results were obtained:

Table 5. The t-coefficient of Digital Learning Artificial Intelligence > Student Learning Motivation

	Path Coefficients (beta)	t-count	P value	Conclusion
AI Digital Learning > Learning Motivation	0.211	0.607	**0.544**	Rejected H1

Source: Data Processing (2025)

Based on the results reported in the table, the path coefficient derived from the original sample estimate ($\beta = 0.211$) is accompanied by a t-statistic of 0.607. These results suggest that the relationship between Digital Artificial Intelligence Learning and Learning Motivation is not statistically significant. In other words, the implementation of AI-based digital learning does not exert a meaningful effect on students' learning motivation. Furthermore, under a two-tailed test (t-critical = 1.97), the observed t-value (0.607) is lower than the critical threshold, and the p-value exceeds the 5% significance level (0.544 > 0.05). Accordingly, H0 is accepted, indicating that Digital Artificial Intelligence Learning does not have a significant influence on students' learning motivation in Riau.

Hypothesis Testing 2:

H2: *Digital Artificial Intelligence Learning* does not have a significant effect on *Student Learning Motivation*

Furthermore, based on the aforementioned hypothesis, hypothesis testing was conducted employing the *bootstrapping* procedure using software, from which the following results were obtained:

Table 6. The t-coefficient of Digital Learning Artificial Intelligence > Student Digital Literacy

	Path Coefficients (beta)	t-count	P value	Conclusion
AI Digital Learning> Digital Literacy	0.360	3.047	**0.002**	Accepted H2

Source: Data Processing (2025)

The results presented in the table indicate that the path coefficient derived from the original sample estimate (β = 0.360) is positive, with a corresponding t-statistic of 3.047. This finding reflects a positive and unidirectional association between Digital Artificial Intelligence Learning and Digital Literacy, suggesting that higher levels of AI-based digital learning are accompanied by increased levels of digital literacy among students. Moreover, the relationship is statistically significant under a two-tailed test (t-critical = 1.97), as the observed t-value (3.047) exceeds the critical threshold and the p-value is below the 5% significance level (0.000 < 0.05). Accordingly, H1 is supported, indicating that Digital Artificial Intelligence Learning has a significant positive effect on students' digital literacy in Riau.

3.4 The Impact of Artificial Intelligence Digital Learning on Learning Motivation

The findings indicate that the effect of Digital Artificial Intelligence Learning on Learning Motivation is not statistically significant. The path coefficient from the original sample estimate (β) shows a negative or non-directional relationship, with a t-value of 0.607. This suggests that Digital Artificial Intelligence Learning does not influence students' Learning Motivation. In the two-tailed test (t-table = 1.97), the calculated t-value (0.607) is lower than the critical value, and the p-value exceeds the 5% significance level (0.544 > 0.05). Therefore, H1 is rejected, indicating that Digital Artificial Intelligence Learning has no significant effect on students' Learning Motivation in Riau.

The results of this study are in line with research that suggests that the use of ITS did not show a significant increase in motivation in some of the studies analyzed (conclusion: the effect on motivation is often inconsistent) (Huang et al., 2025). These results are in line with research with a student sample showing that the context of clinical assessment reported that AI tools did not improve academic performance nor significantly reduce anxiety/test implications. The impact on motivation was also neutral (Ali et al., 2025). The results of the study also point to a possible negative effect: over-reliance on AI dialogue systems makes some students less motivated to try/innovate because answers are readily available. These results show the potential for *no-net-gain* or even decreased motivation when implementation is poor (Zhai et al.. 2024).

The same study further indicates that perceptions of AI's impact and attitudes toward AI training significantly influence individuals' attitudes. However, understanding AI tools and their broader implications does not significantly affect attitudes or motivation (Rajapakse et al., 2024). Research has also found that negative experiences arise, especially if students' expectations of AI are unrealistic/misconception; the influence of learning motivation is not always positive. Some students feel disappointed or less motivated when AI tools don't match what they expect (Naila et al., 2023).

In contrast to the results of the study, which found that students who learned with *custom AI tutors* felt more engaged and more motivated than the active learning group in the classroom, the motivation scores of the AI group were higher, and statistically significant differences were reported (Kestin et al., 2025). Research also reports that the use of AI tools correlates with increased engagement and perception of the learning experience. which contributes to motivation (Vieriu & Petrea, 2025). Research also on college students shows that the use of AI lowers anxiety. increases satisfaction and positive emotions that encourage intentional continuous use and motivation to learn (L. Wang & Li, 2024). These findings are reinforced by previous research indicating that AI-powered tools in education can enhance students' intrinsic motivation and improve the quality of the learning experience,

provided that they are designed and implemented with appropriate pedagogical considerations (Mohamed et al.. 2025). Research also shows that Studies examining the role of teacher support in the use of AI chatbots show that when there is teacher support. students' motivation to learn increases more clearly (K. Wang et al., 2025). The study also concluded that AIEd interventions (especially ITS and adaptive tutors) generally increased engagement/motivation, although the magnitude of the effect varied (Jin Wang & Wenxiang Fan, 2010).

The findings of this study indicate that the implementation of Artificial Intelligence (AI)–based digital learning does not provide a significant contribution to the enhancement of students' learning motivation. These findings indicate a disconnect between the availability of advanced technology and students' psychological motivation to learn. In the local context in Riau Province, this phenomenon can be analyzed through several factors, First, the uneven variation of digital infrastructure in various regions of Riau causes inconsistent *user experience*. Technical obstacles, such as network stability, can hinder the process of exploring technology, so instead of motivating, the use of AI actually becomes a technical burden for students.

Second, there are strong indications that students are not used to using AI pedagogically. Many college students tend to use AI platforms only as instant instruments or "shortcuts" to complete academic assignments without going through a deep cognitive process. This superficial usage pattern fails to foster motivation because students' learning orientation is more focused on the final result (*result-oriented*) than on the process of acquiring knowledge. In addition, the limitations of early digital literacy are a major obstacle to the effective use of AI. The inability of students to formulate proper instruction (*prompt engineering*) often causes frustration. This condition triggers the emergence of academic anxiety or *technostress*, where technology is no longer seen as a support for learning, but rather as a new source of pressure that lowers their self-efficacy and motivation. Thus, the integration of AI in education in higher education requires adequate mental readiness and digital literacy for this technology to function as a motivational catalyst and not just a tool for task automation.

3.5 The Impact of Artificial Intelligence Digital Learning on Digital Literacy

The findings indicate that Digital Artificial Intelligence–based learning exerts a statistically significant influence on students' digital literacy. The path coefficient derived from the original sample estimate ($\beta = 0.360$) is positive, reflecting a direct and unidirectional relationship between Digital Artificial Intelligence Learning and Digital Literacy. This suggests that increases in the implementation of AI-based digital learning are associated with corresponding improvements in students' digital literacy, and vice versa. Furthermore, the relationship is statistically significant under a two-tailed test (t-critical = 1.97), as evidenced by a t-statistic of 3.047, which exceeds the critical threshold, and a p-value of 0.000, which is well below the 0.05 significance level. Accordingly, H2 is supported, confirming that Digital Artificial Intelligence Learning has a significant positive effect on students' digital literacy in Riau.

The findings of this study are consistent with previous research indicating a significant improvement in students' digital literacy following the implementation of AI-based learning compared to their levels prior to the intervention (Anita Candra Dewi, 2025). Likewise. Research suggests that there is great potential and practice that AI literacy is starting to emerge from an early age, so that children are adaptive to technological developments. However. Research is still limited, and there are not many performative measurements/actual skills (Khosibah et al., 2025). The study further found that both AI utilization and digital literacy exert a positive influence on students' learning outcomes in the Learning Evaluation course. This means that students with better digital literacy and more frequent use of AI technology tend to get higher learning outcomes (Nasution & Nurul Amalia, 2024)

The results of the study also show that AI-based learning tools in Science and Social subjects are proven to be practical and valid to use; Teachers and students report that the tool helps improve digital literacy in elementary schools (Faizal et al., 2025). Research also shows that after training. teachers' digital literacy increases; materials. Delivery methods and practical activities are very helpful; the

teacher responds positively (Widiyatmoko et al., 2025). The research also suggests that AI-based educators' digital literacy significantly affects the effectiveness of learning and educator performance. The influence value is quite large (around 54-59%), indicating that educators with better digital literacy can organize learning more effectively (Wulandari et al., 2025)

Consistent with previous studies, the findings indicate that most students perceive the use of AI in English Language Teaching (ELT) as beneficial for improving digital literacy skills, enhancing technological confidence, and fostering critical thinking and creativity, although concerns remain regarding teacher competence and supporting infrastructure (Tatipang et al., 2025). Similarly, prior research has shown that AI is often portrayed optimistically in the media as a comprehensive solution, despite the fact that many individuals still lack sufficient digital literacy to critically assess AI-generated content, creating a gap between media narratives and public capabilities (Sonni et al., 2025). In the educational context, AI-enhanced tools have also been found to increase student participation, active learning time, and academic outcomes, particularly in STEM subjects; however, limited digital literacy, algorithmic bias, and privacy concerns continue to present significant challenges (Zain & Abdullah, 2025). In line with these findings, the present study reveals that AI has a strong positive influence on students' digital literacy, even though it does not significantly affect learning motivation. This result is reasonable because the use of AI requires students to access, evaluate, and process digital information while engaging critically with AI-generated feedback. Supported by established digital literacy frameworks such as UNESCO, Eshet-Alkalai, and DigComp, the findings confirm that sustained interaction with technology can significantly strengthen students' digital literacy through practical and hands-on learning experiences.

4. CONCLUSION

This study concludes that AI-based digital learning has a significant positive effect on students' digital literacy in Riau, but it does not significantly enhance their learning motivation. Specifically, while greater use of AI in learning environments was associated with improved digital literacy, its influence on motivation was statistically insignificant, indicating that AI integration alone is insufficient to foster stronger student engagement. These findings suggest that AI serves more effectively as a tool for developing digital competencies than as a direct driver of motivational outcomes. A key limitation of this study is its focus on a specific regional context and its reliance on quantitative measures, which may not fully capture contextual, pedagogical, and psychological factors influencing students' motivation. Therefore, future research should examine broader and more diverse samples, incorporate qualitative or mixed-method approaches, and explore moderating variables such as teaching strategies, student readiness, and learning environments. In addition, future studies should investigate how AI can be combined with interactive approaches—such as collaborative learning, gamification, and reward-based systems—to enhance both digital literacy and student motivation more effectively.

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