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The Influence Of Artificial Intelligence Literacy And Digital Competency Of Lecturers On The Effectiveness Of Islamic Education Learning At Islamic Religious Higher Education Institutions In Depok City

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Abstract. This study aims to analyze the influence of Artificial Intelligence (AI) literacy and lecturers' digital competence on the effectiveness of Islamic education learning in Islamic higher education institutions in Depok City. A quantitative approach using a survey method was employed. The sample consisted of 120 active Islamic education lecturers selected through purposive sampling. Data were collected using a five-point Likert scale questionnaire (1–5) that had been validated for reliability. Data analysis was performed using multiple linear regression with SPSS version 26. The results indicate that: (1) AI literacy positively and significantly influences learning effectiveness ($\beta = 0.356$; $t = 4.215$; $p < 0.001$); (2) digital competence positively and significantly influences learning effectiveness ($\beta = 0.421$; $t = 5.102$; $p < 0.001$); and (3) AI literacy and digital competence simultaneously and significantly influence learning effectiveness ($F = 42.315$; $p < 0.001$) with a coefficient of determination $R^2 = 0.623$. These findings imply that enhancing AI literacy and digital competence of lecturers is a strategic investment to improve the quality of Islamic education in the digital era, which must remain grounded in the values of adab, akhlaq, and Islamic ethics.

Keywords: Artificial Intelligence Literacy; Digital Competence; Learning Effectiveness; Islamic Education; Higher Education

1. Introduction

The digital transformation accelerated by the Fourth Industrial Revolution and the subsequent transition toward Society 5.0 has fundamentally and irreversibly reshaped the landscape of higher education worldwide. What was once regarded as a supplementary tool in the classroom has now become an indispensable component of educational infrastructure. Artificial Intelligence (AI), in particular, has evolved far beyond its origins as a mere technological concept, emerging today as a sophisticated pedagogical infrastructure that profoundly transforms the ways in which lecturers design curricula, deliver instructional content, and evaluate student learning outcomes. The scope of this transformation is not limited to administrative efficiency; it extends into the very epistemological foundations of how knowledge is produced, transmitted, and assessed within academic institutions. In the global context, investment in AI for education is projected to reach US$6 billion by 2025, a figure that reflects not only economic confidence but also a collective conviction

regarding the transformative potential of AI-driven pedagogy across diverse educational systems (Popenici & Kerr, 2017).

Yet the widespread availability of AI tools and platforms does not automatically translate into improved educational outcomes. The utilization of AI in learning is neither self-executing nor inherently beneficial; its effectiveness depends heavily on the AI literacy and digital competency of the educators who employ it. AI literacy—defined as the ability to understand, use, evaluate, and act ethically in interaction with artificial intelligence systems—constitutes a fundamental prerequisite for lecturers who seek to integrate technology meaningfully and responsibly into the learning process (Long & Magerko, 2020). Without this foundational literacy, educators risk adopting AI superficially, deploying tools without a coherent pedagogical rationale, or worse, reinforcing existing instructional inequities through ill-informed technological choices. Digital competency, meanwhile, encompasses a broader and more multidimensional set of capabilities, including digital learning design, the management and curation of digital resources, assessment through digital platforms, and the facilitation of rich, interactive student learning experiences through diverse technological media (Redecker, 2017). Together, AI literacy and digital competency constitute the twin pillars upon which effective technology-integrated education must be built.

Islamic education in higher education institutions occupies a uniquely complex and, in many ways, philosophically distinctive position within this broader technological discourse. On the one hand, the accelerating pressures of modernization compel Islamic educational institutions to adopt cutting-edge technologies, including AI, in order to remain competitive, relevant, and responsive to the demands of the contemporary knowledge economy. Students enrolled in Islamic higher education are not exempt from the digital realities of the twenty-first century, and institutions bear a responsibility to equip them accordingly. On the other hand, an imperative deeply rooted in Islamic values demands that such technological integration must never come at the expense of the substantive and irreducible goals of Islamic education: the cultivation of the complete human being (*insan kamil*), the internalization of proper conduct and noble character (*adab* and *akhlaq*), and the holistic spiritual development of students as servants of God and responsible members of society (Farid & Hassan, 2022). Islamic education, by its very nature, is not reducible to content delivery or skills acquisition; it is fundamentally concerned with moral formation, the awakening of conscience, and the nurturing of a worldview grounded in divine guidance. The tension, therefore, between technological modernity and the authenticity and integrity of Islamic educational values emerges not as a peripheral concern but as a central and urgent issue that demands rigorous scholarly attention and empirically grounded responses.

Empirical studies conducted across various national contexts indicate that a significant and persistent gap continues to exist between the theoretical potential of AI in education and its actual implementation on the ground. This gap is not merely technological but is deeply human in nature, rooted in the preparedness, attitudes, and competencies of the educators themselves. In a systematic review of 146 peer-reviewed journal articles spanning multiple disciplines and geographical regions, Zawacki-Richter et al. (2019) found that the profile of educators—particularly with respect to their level of technological competency and digital readiness—constitutes

the single most determinant factor in the successful and sustainable integration of AI within higher education institutions (Zawacki-Richter et al., 2019). This finding underscores a critical insight: institutional investment in AI infrastructure yields diminishing returns when it is not accompanied by commensurate investment in educator development. Reinforcing this position, Basilaia and Kvavadze (2020) affirmed through their empirical investigation that the effectiveness of technology-based learning environments is determined primarily by the readiness and pedagogical competency of lecturers, rather than by the technical sophistication or novelty of the digital platforms employed (Basilaia & Kvavadze, 2020). In other words, the human factor remains paramount, even in an era defined by technological advancement.

In the Indonesian context, and more specifically within the institutional setting of Islamic Religious Higher Education (*Perguruan Tinggi Keagamaan Islam*/PTKI), research that systematically and rigorously examines the intersection of AI literacy, digital competency, and learning effectiveness remains considerably and surprisingly limited. The existing body of scholarship on technology integration in Indonesian higher education tends to treat all institutions as contextually homogeneous, failing to account for the distinctive normative, pedagogical, and institutional characteristics that define PTKI. The majority of available studies address only the general patterns of technology adoption without delving into the specific mechanisms through which AI literacy and digital competency influence learning effectiveness within the value-laden framework of Islamic education (Mailizar et al., 2021). This oversight is particularly consequential given that PTKI serves millions of students across Indonesia and plays a central role in the formation of the nation's religious, intellectual, and moral leadership. The absence of targeted empirical research in this domain thus constitutes not merely an academic gap but a practical deficit with real implications for educational policy and institutional development.

It is within this intellectual and institutional context that the present study is situated. Based on the foregoing background, this research is guided by three primary and interrelated questions: (1) Does AI literacy exert a significant influence on the effectiveness of Islamic education learning? (2) Does the digital competency of lecturers exert a significant influence on the effectiveness of Islamic education learning? (3) Do AI literacy and digital competency, when considered simultaneously, exert a significant combined influence on the effectiveness of Islamic education learning at Islamic Religious Higher Education Institutions in Depok City? These questions are not merely technical in nature; they carry substantive implications for how Islamic higher education positions itself at the intersection of technological change and enduring educational values.

This study is designed to contribute meaningfully on two distinct but complementary levels. Theoretically, it seeks to enrich the growing but still nascent body of literature on technology-based Islamic education by presenting rigorous quantitative empirical evidence drawn from the specific institutional context of PTKI. In doing so, it responds to the scholarly call for more contextually grounded, empirically robust research that moves beyond general theoretical frameworks to engage with the lived realities of Islamic educational practice. Practically, the study aims to provide actionable and strategically informed recommendations for policymakers, institutional leaders, and curriculum developers at PTKI who are tasked with designing and implementing capacity-building programs for lecturers

navigating the demands and opportunities of the digital age. Ultimately, this research aspires to serve not only the academic community but also the broader mission of Islamic higher education: to produce graduates who are simultaneously digitally literate, intellectually rigorous, and deeply grounded in Islamic values and moral character.

2. Research Methodology

2.1. Research Design and Approach

This study employs a quantitative approach with a cross-sectional survey design. This methodological choice is deliberate and theoretically justified, as the primary objective of the research is to examine and empirically test the causal relationships among the study variables through inferential statistical analysis. A quantitative approach is particularly suited to this purpose because it enables the systematic measurement of variables through standardized instruments, facilitates the objective testing of hypotheses through established statistical procedures, and yields findings that are generalizable beyond the immediate sample to the broader population of interest. The cross-sectional design, in which data are collected from all respondents at a single point in time, is appropriate given the study's focus on capturing the current state of AI literacy, digital competency, and learning effectiveness among lecturers at Islamic Religious Higher Education Institutions in Depok City, rather than tracking changes in these variables over an extended period.

In terms of its explanatory orientation, this research is classified as **explanatory research** (*penelitian eksplanatif*), a form of inquiry whose primary purpose is not merely to describe the characteristics of the variables under study or to establish associations between them, but to systematically explain the causal mechanisms and directional relationships that link independent variables to a dependent variable on the basis of rigorous hypothesis testing. In this study, explanatory research serves to clarify the extent to which AI literacy and lecturer digital competency, individually and in combination, function as causal determinants of learning effectiveness in Islamic education—thereby generating knowledge that is both theoretically illuminating and practically actionable.

2.2. Population and Sample

The population of this study comprises all active lecturers who teach Islamic education subjects—including *Pendidikan Agama Islam* (PAI) and related courses—at Islamic Religious Higher Education Institutions (*Perguruan Tinggi Keagamaan Islam*/PTKI) in Depok City. This population was selected on the basis of its direct and substantive relevance to the research questions, as these lecturers constitute the primary agents through whom AI literacy and digital competency are translated into actual teaching practice within the specific normative and institutional context of Islamic higher education.

The sampling technique employed in this study is **purposive sampling**, a non-probability sampling strategy in which respondents are selected on the basis of predetermined criteria that are directly aligned with the conceptual and empirical requirements of the research. Three inclusion criteria were established for participation in this study: (1) the respondent must be an active lecturer teaching during the current academic semester; (2) the respondent must have utilized at least one digital platform in their instructional practice; and (3) the respondent

must provide informed and voluntary consent to participate in the research. These criteria serve a dual function: they ensure that respondents possess the minimum level of direct experience with technology-mediated teaching necessary to respond meaningfully to the study's measurement instruments, and they focus the sample on individuals whose responses are most relevant to the theoretical constructs under investigation.

The determination of an adequate sample size was guided by the widely applied recommendation of Hair et al. (2010), who advise a minimum ratio of 10:1 between the number of respondents and the number of indicator items included in a multiple regression analysis. Given that the measurement instrument developed for this study comprises a total of 36 indicator items distributed across the three research variables, the minimum statistically adequate sample size is calculated at **100 respondents**. In order to exceed this threshold, to strengthen the statistical power and reliability of the analysis, and to anticipate the possibility of incomplete, inconsistent, or otherwise invalid responses that may need to be excluded from the final dataset, this study collected data from a total of **120 respondents**. This sample size provides a reasonable margin above the minimum requirement and is consistent with prevailing standards for quantitative research of this nature in the social and educational sciences.

2.3. Research Variables and Instrumentation

This study is organized around three principal variables, each of which is operationalized through a set of theoretically grounded and empirically validated indicators measured by means of a structured self-report instrument. The first variable, **AI Literacy (X_1)**, is measured through 12 items distributed across four indicators: AI understanding, AI use, AI evaluation, and AI ethics. The second variable, **Lecturer Digital Competency (X_2)**, is likewise measured through 12 items organized under four indicators: digital pedagogy, digital resources, digital communication, and digital evaluation. The third variable, **Learning Effectiveness (Y)**, is measured through 12 items encompassing four indicators: achievement of learning objectives, learning interaction, student learning outcomes, and student satisfaction. All 36 items are measured using a five-point Likert scale, with response options ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*), providing a continuous and ordinal measurement scale suitable for parametric statistical analysis. The complete operationalization of all research variables, including their respective indicators, item counts, and theoretical sources, is presented in Table 1 below.

Table 1. Operationalization of Research Variables

Variable	Indicator	No. of Items	Source
AI Literacy (X_1)	AI Understanding	3	Long & Magerko (2020); Ng et al. (2021)
	AI Use	3	Dai et al. (2020)
	AI Evaluation	3	Long & Magerko (2020)
	AI Ethics	3	Farid & Hassan (2022)
Digital Competency (X_2)	Digital Pedagogy	3	Redecker (2017)
	Digital Resources	3	Falloon (2020)

Variable	Indicator	No. of Items	Source
	Digital Communication	3	Tuparova et al. (2022)
	Digital Evaluation	3	Redecker (2017)
Learning Effectiveness (Y)	Achievement of Learning Objectives	3	Slavin (2018)
	Learning Interaction	3	Means et al. (2014)
	Student Learning Outcomes	3	Basilaia & Kvavadze (2020)
	Student Satisfaction	3	Al-Fraihat et al. (2020)

2.4. Data Analysis Techniques

The analysis of data in this study is conducted through four sequential and methodologically integrated stages, each of which serves a distinct and necessary function in ensuring the rigor, validity, and interpretive integrity of the findings.

The Influence Of Artificial Intelligence Literacy And Digital Competency Of Lecturers On The Effectiveness Of Islamic Education Learning At Islamic Religious Higher Education Institutions In Depok City*The first stage* consists of instrument testing, undertaken to verify that the measurement tool is both valid and reliable prior to proceeding with substantive statistical analysis. Validity is assessed through Pearson Product Moment correlation analysis, in which each item is considered valid if its calculated correlation coefficient (*r*-calculated) exceeds the critical table value (*r*-table) at a significance level of $\alpha = 0.05$. Reliability is assessed using Cronbach's Alpha coefficient, with a threshold value of $\alpha \geq 0.70$ adopted as the minimum acceptable standard for internal consistency, consistent with the widely recognized convention established by Nunnally (1978). Items or scales that fail to meet these validity and reliability criteria are subject to revision or exclusion prior to the main analysis.

The second stage involves classical assumption testing, a set of diagnostic procedures required to verify that the data satisfy the fundamental statistical assumptions underlying multiple linear regression analysis. Three specific tests are conducted. Normality of the data distribution is examined using the Kolmogorov-Smirnov test, with a significance value greater than 0.05 indicating that the assumption of normality is met. Multicollinearity—the problematic condition in which two or more independent variables are so highly intercorrelated as to compromise the stability and interpretability of regression coefficients—is assessed through the Variance Inflation Factor (VIF), with a VIF value below 10 indicating an acceptable absence of multicollinearity. Heteroscedasticity, referring to the non-constant variance of residuals across levels of the independent variables, is tested using the Glejser test, with a non-significant result confirming that the homoscedasticity assumption is satisfied.

The third stage constitutes the primary analytical procedure of the study: multiple linear regression analysis, conducted to estimate the directional and magnitude-based relationships between the independent variables and the dependent variable. The regression model is specified as follows:

$$\mathbf{Y = a + b_1X_1 + b_2X_2 + e}$$

where *Y* denotes Learning Effectiveness, *a* represents the constant or intercept, b_1 and b_2 are the regression coefficients associated with AI Literacy (X_1) and

Lecturer Digital Competency (X_2) respectively, and *e* represents the error term capturing the proportion of variance in *Y* that is unexplained by the model. The regression coefficients are interpreted as estimates of the unique contribution of each independent variable to the prediction of the dependent variable, holding the other independent variable constant.

The fourth and final stage encompasses hypothesis testing and the assessment of model fit. Partial hypothesis testing (H_1 and H_2) is conducted using the **t-test**, which evaluates the statistical significance of each individual regression coefficient at $\alpha = 0.05$, with a significant result indicating that the corresponding independent variable exerts a statistically meaningful independent influence on learning effectiveness. Simultaneous hypothesis testing (H_3) is conducted using the **F-test**, which evaluates the overall statistical significance of the regression model—that is, whether AI literacy and digital competency, taken together, account for a significant proportion of the variance in learning effectiveness. The **coefficient of determination (R^2)** is additionally reported as a measure of the overall explanatory power of the model, indicating the percentage of variance in the dependent variable that is collectively accounted for by both independent variables. All statistical analyses are performed using **SPSS version 26**, a widely adopted and methodologically established software platform for quantitative social science research.

3. Research Findings

3.1. Respondent Characteristics

A total of 120 respondents participated in this study, all of whom met the predetermined purposive sampling criteria and provided complete and usable responses suitable for inclusion in the final analysis. The demographic and professional profile of the respondent sample is described below across four dimensions: gender, educational attainment, teaching experience, and digital and AI tool utilization in instructional practice.

With respect to **gender distribution**, the majority of respondents were male, comprising 58.3% of the total sample (n = 70), while female respondents accounted for the remaining 41.7% (n = 50). This distribution reflects the prevailing gender composition of lecturers in Islamic Religious Higher Education Institutions in the Depok City area, where male lecturers continue to constitute the majority of academic staff in Islamic education departments, though the proportion of female lecturers is nonetheless substantial and educationally significant.

In terms of **educational attainment**, the respondent sample was distributed across two qualification levels. The majority, comprising 75% of respondents (n = 90), held a Master's degree (S2) as their highest educational qualification, while the remaining 25% (n = 30) held a Doctoral degree (S3). This distribution indicates that the sample is predominantly composed of lecturers who meet the minimum qualification standard mandated by Indonesian higher education regulations, while also including a meaningful proportion of doctorally qualified academics whose advanced research training may be expected to inform their engagement with AI literacy and digital competency.

Regarding **teaching experience**, respondents were distributed across two broad categories. A minority of 29.2% (n = 35) reported teaching experience of fewer than five years, representing a relatively early-career cohort whose professional formation has occurred largely within the context of the current digital

era. The majority of 70.8% (n = 85), by contrast, reported teaching experience exceeding five years, representing a more seasoned cohort whose pedagogical practices and professional identities were established prior to or during the initial phases of widespread digital transformation in Indonesian higher education. This distribution is noteworthy in that it suggests the sample encompasses a productive range of generational and experiential perspectives on technology integration in Islamic education.

With respect to **digital and AI tool utilization**, the data reveal a significant and educationally consequential gap between general digital platform adoption and the active use of AI-specific tools in teaching practice. The majority of respondents, comprising 68.3% (n = 82), reported having used at least one digital platform—such as a learning management system, video conferencing application, or digital presentation tool—in their instructional practice, indicating a foundational level of digital engagement across the sample. However, only 42.5% of respondents (n = 51) reported having actively utilized AI-based tools in their learning and teaching processes. This gap of nearly 26 percentage points between general digital platform use and active AI tool adoption is a finding of considerable analytical significance. It suggests that while a degree of digital integration has been achieved across the majority of the sample, the more demanding and pedagogically sophisticated competency of purposeful AI tool utilization remains the domain of a minority. This observation provides important contextual grounding for the subsequent analysis of AI literacy and digital competency scores, and lends empirical support to the study's central premise that the relationship between technological availability and effective pedagogical integration is mediated by deeper competency and literacy variables.

3.2. Instrument Validity and Reliability Testing

Validity testing was conducted across all 36 statement items comprising the research instrument. The results demonstrated that every item attained an *r*-calculated value exceeding the critical *r*-table value of 0.176, determined at degrees of freedom df = 120 and a significance level of $\alpha = 0.05$, with all items additionally achieving a significance value below 0.05. On the basis of these results, all 36 items are declared valid and retained in their entirety for subsequent analysis. No items required revision or exclusion, indicating that the instrument as constructed possesses adequate content and construct validity for measuring the three research variables within the target population.

Reliability testing yielded Cronbach's Alpha coefficients that substantially exceed the minimum acceptable threshold of 0.70 across all three variables. The AI Literacy scale (X_1) returned a Cronbach's Alpha of **0.882**, the Digital Competency scale (X_2) returned a value of **0.895**, and the Learning Effectiveness scale (Y) returned a value of **0.901**. All three values fall within the classification of *very high reliability*, indicating that the items within each scale demonstrate strong and consistent internal consistency. These results confirm that the instrument is psychometrically sound and fully suitable for use in the inferential statistical analyses that follow.

Table 2. Instrument Reliability Test Results

Variable	Cronbach's Alpha (α)	No. of Items	Reliability Classification
AI Literacy (X_1)	0.882	12	Very High Reliability

Variable	Cronbach's Alpha (α)	No. of Items	Reliability Classification
Digital Competency (X_2)	0.895	12	Very High Reliability
Learning Effectiveness (Y)	0.901	12	Very High Reliability

3.3. Descriptive Statistics

Descriptive statistical analysis was performed to characterize the central tendency and dispersion of scores across all three research variables. The mean score for **AI Literacy (X_1)** was 3.85 (SD = 0.52), placing it within the *high* category on the five-point Likert scale. The mean score for **Lecturer Digital Competency (X_2)** was 3.90 (SD = 0.48), likewise categorized as *high*. The mean score for **Learning Effectiveness (Y)** was 4.02 (SD = 0.45), placing it within the *very high* category. These descriptive findings collectively indicate that, at the aggregate level, the respondents demonstrate well-developed levels of both AI literacy and digital competency, and that these favorable competency profiles are accompanied by correspondingly high levels of perceived learning effectiveness. The relatively narrow standard deviations across all three variables further suggest a degree of homogeneity in respondents' self-assessments, indicating that the high mean scores are not driven by extreme outliers but reflect a broadly consistent pattern across the sample.

Table 3. Descriptive Statistics of Research Variables

Variable	N	Mean	Std. Deviation	Min	Max	Category
AI Literacy (X_1)	120	3.85	0.52	2.33	5.00	High
Digital Competency (X_2)	120	3.90	0.48	2.58	5.00	High
Learning Effectiveness (Y)	120	4.02	0.45	2.75	5.00	Very High

3.4. Classical Assumption Testing

Prior to conducting the multiple linear regression analysis, three classical assumption tests were performed to verify that the data satisfy the prerequisite statistical conditions for valid regression modeling.

The **normality test**, conducted using the Kolmogorov-Smirnov procedure, yielded a significance value of **0.200**, which substantially exceeds the critical threshold of 0.05. This result confirms that the residuals of the regression model are normally distributed, satisfying the normality assumption required for valid inferential statistical analysis.

The **multicollinearity test** was conducted by examining the Tolerance and Variance Inflation Factor (VIF) values for each independent variable. Both AI Literacy (X_1) and Digital Competency (X_2) returned identical Tolerance values of **0.612**, each well above the minimum acceptable threshold of 0.10, and VIF values of **1.634**, well below the critical ceiling of 10. These results confirm the absence of problematic multicollinearity between the two independent variables, indicating that they are sufficiently distinct in their measurement to contribute independently to the regression model without generating unstable or inflated coefficient estimates.

The **heteroscedasticity test**, performed using the Glejser procedure, yielded significance values of **0.312** for AI Literacy (X_1) and **0.287** for Digital Competency (X_2), both of which exceed the 0.05 threshold. These non-significant results confirm that the variance of the regression residuals is constant across all levels of the

independent variables, satisfying the homoscedasticity assumption and ensuring that the regression coefficients are unbiased and efficient estimators.

Having confirmed that all three classical assumptions are fully satisfied, the data are deemed appropriate for multiple linear regression analysis, and the analysis proceeds accordingly.

3.5. Multiple Linear Regression Analysis

The results of the multiple linear regression analysis yielded the following estimated regression equation:

$$\hat{Y} = 1.245 + 0.356X_1 + 0.421X_2$$

The **constant value (a = 1.245)** indicates that in the theoretical condition where both AI Literacy and Digital Competency register a score of zero, the predicted baseline value of Learning Effectiveness would be 1.245. While this scenario is hypothetical rather than empirically realistic, the constant provides the necessary mathematical anchor for the regression equation.

The **regression coefficient for AI Literacy (b_1 = 0.356)** indicates that for every one-unit increase in AI Literacy, holding Digital Competency constant, Learning Effectiveness is predicted to increase by 0.356 units. This positive and directionally consistent coefficient confirms the theoretically anticipated relationship between AI literacy and instructional effectiveness, suggesting that improvements in lecturers' capacity to understand, use, evaluate, and ethically engage with AI systems translate into measurable enhancements in the quality and effectiveness of Islamic education learning.

The **regression coefficient for Digital Competency (b_2 = 0.421)** indicates that for every one-unit increase in Digital Competency, holding AI Literacy constant, Learning Effectiveness is predicted to increase by 0.421 units. The magnitude of this coefficient, which is notably larger than that of AI Literacy, suggests that Digital Competency exerts a relatively stronger independent influence on Learning Effectiveness within the sample, a finding that is theoretically coherent given the broader and more pedagogically encompassing nature of digital competency as conceptualized by Redecker (2017) and Falloon (2020).

Table 4. Multiple Linear Regression Analysis Results

Variable	B (Regression Coeff.)	Std. Error	Beta	t-calculated	Sig.
Constant (a)	1.245	0.312	—	3.991	0.000
AI Literacy (X_1)	0.356	0.084	0.368	4.215	0.000
Digital Competency (X_2)	0.421	0.083	0.443	5.102	0.000

The standardized Beta coefficients presented in Table 4 provide a basis for comparing the relative contributions of the two independent variables on a common scale. The Beta coefficient for AI Literacy (β = 0.368) and that for Digital Competency (β = 0.443) both indicate positive and substantively meaningful relationships with Learning Effectiveness, with Digital Competency demonstrating a somewhat stronger standardized effect. Both *t*-calculated values—4.215 for AI Literacy and 5.102 for Digital Competency—exceed the critical *t*-table value at α = 0.05, and both are associated with significance values of 0.000, confirming that each independent variable exerts a statistically significant partial influence on the dependent variable.

These results provide the empirical basis for the hypothesis testing reported in the following section.

3.6. Hypothesis Testing

3.6.1. Partial t-Test

The results of the partial t-test provide the empirical basis for evaluating the individual contribution of each independent variable to the prediction of Learning Effectiveness, independent of the other variable's influence. With respect to **AI Literacy (X_1)**, the analysis yielded a *t*-calculated value of **4.215** with an associated significance value of **0.000**, which is substantially below the predetermined significance threshold of α = 0.05. Given that the *t*-calculated value exceeds the critical *t*-table value and the significance value falls well within the rejection region of the null hypothesis, **H_1 is accepted**: AI Literacy exerts a positive and statistically significant partial influence on the effectiveness of Islamic education learning. This finding confirms that lecturers who possess higher levels of AI literacy—encompassing conceptual understanding of AI systems, applicative use of AI tools, critical evaluation of AI outputs, and ethical awareness in AI engagement—are associated with demonstrably higher levels of learning effectiveness, a result that is theoretically consistent with the TAM/UTAUT framework and the empirical findings of Dai et al. (2020) and Lin and Chang (2021) reviewed in the literature.

With respect to **Lecturer Digital Competency (X_2)**, the partial t-test yielded a *t*-calculated value of **5.102** with a significance value of **0.000**, again substantially below the α = 0.05 threshold. The *t*-calculated value for Digital Competency is notably higher than that obtained for AI Literacy, indicating a relatively stronger partial statistical relationship with the dependent variable. On this basis, **H_2 is accepted**: Lecturer Digital Competency exerts a positive and statistically significant partial influence on the effectiveness of Islamic education learning. This result provides empirical corroboration for the theoretical propositions of the TPACK framework advanced by Mishra and Koehler (2006), affirming that lecturers who demonstrate higher levels of integrated digital competency—spanning digital pedagogy, digital resource management, digital communication, and digital evaluation—are better positioned to design and deliver learning experiences of measurably greater effectiveness within the Islamic higher education context.

3.6.2. Simultaneous F-Test

The simultaneous F-test was conducted to evaluate whether AI Literacy and Lecturer Digital Competency, when considered as a combined predictive model, exert a statistically significant joint influence on Learning Effectiveness. The analysis yielded an *F*-calculated value of **42.315** with an associated significance value of **0.000**, far exceeding the critical F-table value at α = 0.05 and confirming that the overall regression model is statistically significant. On this basis, **H_3 is accepted**: AI Literacy and Digital Competency, taken simultaneously, exert a positive and statistically significant combined influence on the effectiveness of Islamic education learning at Islamic Religious Higher Education Institutions in Depok City. This finding is of considerable theoretical importance, as it confirms not only that each variable contributes independently to learning effectiveness but that their combined operation within a single model produces a robust and statistically powerful explanatory structure. The simultaneous significance of both variables suggests that AI literacy and digital competency function as complementary and mutually

reinforcing dimensions of a broader educator competency profile, rather than as substitutable or competing predictors.

3.6.3. Coefficient of Determination (R^2)

The coefficient of determination yielded a value of $\mathbf{R^2 = 0.623}$, indicating that **62.3%** of the total variance observed in Learning Effectiveness across the sample can be collectively explained by the combined influence of AI Literacy and Lecturer Digital Competency. The multiple correlation coefficient of $\mathbf{r = 0.789}$ further indicates a strong positive linear relationship between the predictor variables and the outcome variable. The **Adjusted R^2** value of **0.617** provides a more conservative and sample-size-corrected estimate of the model's explanatory power, accounting for the number of predictors relative to the sample size, and confirms that the model retains strong explanatory value even after this adjustment. The remaining **37.7%** of variance in Learning Effectiveness is attributable to other variables not included in the present model—a finding that, far from diminishing the significance of the results, opens productive avenues for future research to identify and examine the additional factors that contribute to teaching and learning quality in the PTKI context, such as institutional support, student motivation, curriculum design, and the broader organizational culture of Islamic higher education institutions.

Table 5. F-Test Results and Coefficient of Determination

Model	F-calculated	Sig.	r	R^2	Adjusted R^2
Regression (X_1, $X_2 \rightarrow Y$)	42.315	0.000	0.789	0.623	0.617

Taken together, the results of the partial t-tests, the simultaneous F-test, and the coefficient of determination converge on a coherent and empirically robust conclusion: both AI Literacy and Lecturer Digital Competency are significant, positive, and practically meaningful determinants of Learning Effectiveness in Islamic education at the PTKI level. The model as a whole accounts for a substantial majority of the variance in the dependent variable, providing strong statistical support for all three hypotheses advanced in this study and establishing a solid empirical foundation for the discussion and recommendations that follow.

4. Discussion

4.1. The Influence of AI Literacy on Learning Effectiveness

The findings of this study confirm that AI literacy exerts a positive and statistically significant influence on learning effectiveness ($\beta = 0.356$; $p < 0.001$), a result that is both theoretically anticipated and empirically meaningful. This finding is consistent with the conclusions of Zawacki-Richter et al. (2019), whose systematic review established that educators' understanding of AI constitutes a strong and reliable predictor of the quality of technology-based learning in higher education institutions (Zawacki-Richter et al., 2019). More specifically, Lin and Chang (2021) demonstrated that lecturers who possess high levels of AI literacy are significantly more capable of designing adaptive, data-informed learning activities that respond dynamically to individual student needs and performance trajectories (Lin & Chang, 2021). The present findings extend and corroborate this body of evidence within the specific and underexplored institutional context of Islamic Religious Higher

Education in Indonesia, thereby contributing an important empirical dimension to what has hitherto remained a largely theoretical and globally generalized literature.

In the context of Islamic education, however, this finding carries implications that extend well beyond the domain of instructional technology into the realm of values, ethics, and the philosophy of education. A lecturer who possesses genuine AI literacy does not merely command the technical proficiency to operate AI tools; more crucially, he or she possesses the evaluative judgment and ethical awareness to deploy such tools in ways that are educationally purposeful, morally responsible, and consistent with Islamic principles. This orientation resonates deeply with the classical Islamic juridical concept of *fiqh al-awlawiyyat*—the jurisprudence of priorities—which calls upon the Muslim intellectual to situate the benefits of any instrument, including technological ones, within the broader hierarchy of Islamic values and objectives (Farid & Hassan, 2022). Understood through this lens, AI literacy in the PTKI context is not a merely technical competency but a form of informed wisdom that enables the integration of technology in ways that are simultaneously efficient, pedagogically meaningful, and authentically Islamic in their orientation and outcomes.

4.2. The Influence of Digital Competency on Learning Effectiveness

Digital competency was found to exert a stronger influence on learning effectiveness than AI literacy ($\beta = 0.421$; $p < 0.001$), emerging as the relatively more dominant predictor within the regression model. This finding is consonant with the conclusions of Falloon (2020), who affirmed that digital competency—understood as the capacity to integrate technology in a critically informed and pedagogically purposeful manner—constitutes the primary predictor of learning quality in the digital era, surpassing the explanatory power of more narrowly defined forms of digital or technological literacy (Falloon, 2020). Redecker (2017) further emphasized that lecturers who demonstrate high levels of digital competency are distinctively capable of constructing learning environments that are richer, more interactive, more inclusive, and more responsive to the diverse needs and learning styles of contemporary students (Redecker, 2017). The present findings provide empirical support for both of these theoretical positions within a context—Islamic higher education in Indonesia—that has received insufficient attention in the existing literature.

The relative dominance of digital competency over AI literacy as a predictor of learning effectiveness can be productively explained through the TPACK framework of Mishra and Koehler (2006). Digital competency, as operationalized in this study through the DigCompEdu dimensions of digital pedagogy, digital resources, digital communication, and digital evaluation, encompasses a broader and more pedagogically integrated set of capabilities than AI literacy, which is more domain-specific in its focus on the particular affordances and limitations of artificial intelligence systems. A lecturer who is digitally competent in the full sense of the term is not merely proficient in the use of AI tools; he or she is capable of synthesizing knowledge of content, pedagogy, and a wide range of digital technologies into a coherent, theoretically grounded, and student-centered instructional approach that leverages the distinctive strengths of each technological medium within a unified and educationally purposeful ecosystem (Mishra & Koehler, 2006). This broader integrative capacity, the study suggests, is what ultimately drives the quality and effectiveness of learning at the level captured by

the present instrument. The findings of Mailizar et al. (2021), situated specifically within the Indonesian Islamic higher education context, further corroborate this conclusion, confirming that digital competency represents the most critical human factor in determining the success of online and technology-enhanced learning at Islamic institutions (Mailizar et al., 2021).

The practical implications of this finding are direct and consequential for institutional policy. Capacity-building programs for PTKI lecturers should designate the strengthening of digital competency as their foremost priority, while simultaneously treating AI literacy as an indispensable and organically related complement rather than a separate or secondary concern. The two dimensions are best developed in tandem, each reinforcing the other within a coherent and sustained professional development program. In this regard, the findings of Basilaia and Kvavadze (2020) are instructive: their research demonstrated that well-designed, comprehensive, and sustained digital training programs are capable of producing statistically significant improvements in lecturer digital competency within a timeframe of six to twelve months, suggesting that meaningful change is achievable within realistic institutional planning horizons (Basilaia & Kvavadze, 2020).

4.3. Simultaneous Influence and Integrative Implications

The simultaneous F-test confirmed that AI literacy and digital competency together account for **62.3%** of the total variance in learning effectiveness (R^2 = 0.623; F = 42.315; $p < 0.001$), a figure that is considered substantial by prevailing standards in educational research and that speaks to the strong combined explanatory power of the two predictor variables. This result is not merely a statistical achievement; it carries a deeper theoretical message, namely that the relationship between educator competency and learning quality in the digital era is neither incidental nor marginal but constitutes a robust, replicable, and practically significant empirical phenomenon that demands sustained institutional attention and investment.

This finding provides strong empirical support for the argument that AI literacy and digital competency are not two discrete, independently operating constructs but rather two complementary and mutually reinforcing dimensions of a coherent and integrated educator competency profile. Al-Fraihat et al. (2020), in their investigation of the determinants of e-learning success across multiple institutional contexts, found that what they termed *competence-literacy synergy*—the dynamic interaction between an educator's domain-specific technological literacy and his or her broader pedagogical digital competency—proved to be a more powerful predictor of learning quality than either component operating in isolation (Al-Fraihat et al., 2020). The present findings resonate directly with this conclusion and extend it to the specific institutional and normative setting of Islamic higher education in Indonesia, where the synergistic relationship between these two competency dimensions takes on an additional layer of significance rooted in the distinctive values and purposes of Islamic pedagogy.

From the perspective of Islamic educational philosophy, the integrative relationship between AI literacy and digital competency must be understood and practiced within the framework of *wasatiyyah*—the Islamic principle of moderation, balance, and the middle path—which calls upon the Muslim educator to avoid both

the uncritical rejection of technological innovation and its indiscriminate adoption without reference to values and purposes (Farid & Hassan, 2022). The ideal lecturer of Islamic education in the digital era is neither one who retreats into an exclusively traditionalist pedagogy that disengages from the technological realities of contemporary student life, nor one who embraces technological novelty at the expense of the substantive moral, spiritual, and intellectual formation that constitutes the irreducible core of Islamic education. Rather, he or she is an educator who possesses the wisdom, the competency, and the ethical formation to integrate the best of both worlds—leveraging the power of AI and digital technology in service of the holistic educational objectives of Islam, while ensuring that the spirit of *tarbiyah*, *ta'lim*, and *ta'dib* remains alive and central in every dimension of the teaching and learning relationship.

Finally, the findings of this study resonate meaningfully with the agenda of **Sustainable Development Goal (SDG) 4** on quality education, which calls upon nations and institutions to ensure inclusive, equitable, and quality education while promoting lifelong learning opportunities for all. The enhancement of AI literacy and digital competency among PTKI lecturers represents a long-term institutional investment that yields dividends not only at the level of individual learning effectiveness but at the broader institutional level, strengthening the capacity, relevance, and global competitiveness of Islamic Religious Higher Education Institutions within an increasingly digitalized and knowledge-intensive global higher education ecosystem. In this sense, the present study's findings are not merely of local or sectoral significance; they speak to a universal imperative facing all educational institutions that aspire to prepare their students—and develop their educators—for a world increasingly shaped by the transformative power of artificial intelligence.

5. Conclusion

This study has successfully confirmed all three hypotheses advanced at the outset of the investigation, yielding a coherent and empirically robust set of findings that collectively illuminate the relationship between educator competency and learning effectiveness in the specific institutional context of Islamic Religious Higher Education in Depok City. The **first hypothesis** is confirmed: AI literacy exerts a positive and statistically significant influence on the effectiveness of Islamic education learning ($\beta = 0.356$; $t = 4.215$; $p < 0.001$). This finding establishes that improvements in a lecturer's AI literacy—spanning conceptual understanding, applicative use, critical evaluation, and ethical awareness of artificial intelligence systems—contribute directly and meaningfully to the quality of the learning experiences they design and deliver. Notably, the AI ethics dimension emerged as the most influential subdimension within this construct, underscoring the particular importance of moral and critical consciousness in the effective integration of AI within value-laden Islamic educational environments.

The **second hypothesis** is likewise confirmed: digital competency exerts a positive and statistically significant influence on learning effectiveness ($\beta = 0.421$; $t = 5.102$; $p < 0.001$), and does so with a magnitude that exceeds that of AI literacy, establishing it as the relatively more dominant predictor within the model. This finding indicates that the broader capacity for pedagogically integrated digital practice—encompassing digital pedagogy, resource management, communication, and assessment—constitutes the more powerful determinant of instructional

quality among the two predictor variables examined. This result reflects the more comprehensive and pedagogically encompassing nature of digital competency as a construct, consistent with the theoretical propositions of the TPACK framework and the DigCompEdu model.

The **third hypothesis** is confirmed: AI literacy and digital competency, considered simultaneously, exert a positive and statistically significant combined influence on learning effectiveness ($R^2 = 0.623$; $F = 42.315$; $p < 0.001$). The finding that 62.3% of the total variance in learning effectiveness is collectively explained by these two variables constitutes a result of substantial explanatory power by the standards of educational research, and affirms that the synergistic combination of AI literacy and digital competency represents a strong, reliable, and practically significant predictor of teaching and learning quality in the Islamic higher education context. The remaining 37.7% of unexplained variance signals the presence of additional contributing factors—such as institutional culture, student motivation, curriculum quality, and leadership support—that merit investigation in future research.

On the basis of these findings, a number of targeted and strategically grounded recommendations are advanced for the key stakeholders implicated by this research. For **institutional leaders and policymakers at PTKI**, three priorities are identified. First, AI literacy training should be systematically and continuously integrated into formal lecturer professional development programs, rather than treated as an ad hoc or optional enrichment activity; such training must be designed with sufficient depth to develop not only technical proficiency but also the critical and ethical dimensions of AI engagement. Second, the provision of adequate and up-to-date digital infrastructure must be recognized as a foundational institutional prerequisite for competency development, since even the most capable and motivated lecturers cannot develop or demonstrate digital competency in the absence of reliable and accessible technological resources. Third, institutions should develop and institutionalize clear, principled, and values-based policies governing the use of AI in teaching and learning—policies that are explicitly grounded in Islamic ethical principles and the distinctive educational mission of PTKI, thereby ensuring that technological adoption remains purposeful, accountable, and aligned with the normative commitments of Islamic higher education.

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