

STRUCTURAL RELATIONSHIPS AMONG AI LITERACY, CRITICAL THINKING, AND RELIGIOUS COPING IN ISLAMIC HIGHER EDUCATION

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Abstract: This study aimed to examine the structural relationships among AI literacy, critical thinking, and religious coping among Tarbiyah students at UIN Kiai Haji Achmad Siddiq Jember, and to evaluate the mediating role of critical thinking. A quantitative correlational-structural design using Structural Equation Modeling (SEM) was applied to a sample of 317 students selected through multistage cluster sampling. Data were collected using structured scales measuring the three latent constructs and analyzed via Confirmatory Factor Analysis and bootstrap mediation testing in Mplus 8.10. The results demonstrated that AI literacy exerts a significant positive direct effect on critical thinking ($\beta = 0.58, p < 0.001$) and religious coping ($\beta = 0.18, p = 0.003$). Furthermore, critical thinking partially mediates the relationship between AI literacy and religious coping ($\beta = 0.25, p < 0.001$), accounting for 58.1% of the total effect. The structural model explained moderate variance in critical thinking ($R^2 = 0.34$) and religious coping ($R^2 = 0.41$). These findings indicate that AI literacy operates as a cognitive-ethical capacity that, by sharpening critical thinking, enables students to engage adaptively with religious resources. Theoretically, critical thinking does not diminish religiosity but bridges digital competence and spiritual capacity; practically, integrating AI literacy with critical thinking and religious coping is an urgent imperative for Islamic higher education.

Keywords: artificial intelligence literacy; critical thinking; religious coping; Islamic higher education.

Abstrak: Penelitian ini bertujuan untuk menguji hubungan struktural antara literasi AI, berpikir kritis, dan religious coping pada mahasiswa Tarbiyah di UIN Kiai Haji Achmad Siddiq Jember, serta mengevaluasi peran mediasi berpikir kritis. Desain kuantitatif korelasional-struktural menggunakan Structural Equation Modeling (SEM) diterapkan pada sampel sebanyak 317 mahasiswa yang dipilih melalui multistage cluster sampling. Data dikumpulkan menggunakan skala terstruktur yang mengukur ketiga konstruk laten dan dianalisis melalui Confirmatory Factor Analysis serta pengujian mediasi bootstrap menggunakan Mplus 8.10. Hasil penelitian menunjukkan bahwa literasi AI memiliki pengaruh

langsung positif yang signifikan terhadap berpikir kritis ($\beta = 0,58$; $p < 0,001$) dan religious coping ($\beta = 0,18$; $p = 0,003$). Selain itu, berpikir kritis memediasi secara parsial hubungan antara literasi AI dan religious coping ($\beta = 0,25$; $p < 0,001$), yang menyumbang sebesar 58,1% dari total pengaruh. Model struktural ini mampu menjelaskan varians tingkat moderat pada berpikir kritis ($R^2 = 0,34$) dan religious coping ($R^2 = 0,41$). Temuan ini menunjukkan bahwa literasi AI berfungsi sebagai kapasitas kognitif-etis yang, dengan mempertajam berpikir kritis, memungkinkan mahasiswa memanfaatkan sumber daya keagamaan secara adaptif. Secara teoretis, berpikir kritis tidak menggerus religiositas, melainkan menjembatani kompetensi digital dan kapasitas spiritual; secara praktis, pengintegrasian literasi AI dengan berpikir kritis dan religious coping merupakan kebutuhan mendesak bagi perguruan tinggi keagamaan Islam.

Kata kunci: literasi AI, kemampuan berpikir kritis, religious coping, pendidikan tinggi Islam

INTRODUCTION

The accelerated adoption of Generative Artificial Intelligence (Generative AI) across higher education ecosystems has fundamentally transformed how university students access information, synthesize knowledge, and navigate academic tasks. Students no longer merely consume AI-generated output; they actively integrate generative tools into their core cognitive workflows—ranging from initial argument formulation and literature synthesis to complex analytical problem-solving.¹ In Islamic higher education, this technological shift presents a distinct pedagogical paradox: while AI offers unprecedented cognitive efficiency and expands access to vast scholarly archives, it simultaneously raises intense concerns regarding the potential erosion of independent inquiry, analytical rigor, and epistemic autonomy.²

Empirical observations within Indonesian Islamic universities indicate that Muslim undergraduate students demonstrate moderate-to-high levels of AI technology adoption and general digital agility. However, technical familiarity is not consistently accompanied by rigorous evaluative capacity.³ Field investigations highlight three predominant epistemic postures among students interacting with

¹ M. Badali dkk., "Bridging AI chatbot use and critical thinking: The mediating role of AI literacy," *Interactive Learning Environments* 34 (2026): 4598–610.

² A. Deveci Topal dkk., "Artificial intelligence literacy scale: A study of reliability and validity in Turkish university students," *Journal of Learning and Teaching in Digital Age* 10, no. 1 (2025): 58–67.

³ N. Saunders dan Z. Stephenson, "Reviewing the use of the Brief Religious Coping Scale (Brief RCOPE) across diverse cultures and populations," *Journal of Religion and Health* 63, no. 5 (2024): 3926–41.

generative AI, pragmatic instrumental agency (focusing on immediate output generation without tracking underlying source citations), explorative critical agency (engaging in comparative verification and systematic follow-up inquiry), and passive receptive agency (uncritically accepting AI outputs as authoritative).⁴ A substantial proportion of students remain susceptible to epistemic outsourcing—delegating the cognitive responsibility of truth-justification to algorithmic systems that appear linguistically authoritative yet remain substantively unverified.

This dynamic becomes especially acute within Faculties of Tarbiyah (Teacher Training), where students are prepared to serve as future educators and moral leaders. These students face a dual mandate: acquiring cutting-edge digital literacy while upholding the epistemic standards of Islamic scholarly traditions. Classical Islamic pedagogy emphasizes sanad (verified chains of transmission), source validation, and active reasoning as integral dimensions of *tafakkur* (systematic reflection) and *ta'qqul* (rational discernment).⁵ Reconciling algorithmic efficiency with Islamic epistemic rigor constitutes an urgent challenge for contemporary Islamic pedagogy.

Recent literature has documented positive associations between AI literacy and critical thinking skills, yet critical theoretical and empirical gaps remain. Badali et al. (2026) demonstrated that AI literacy acts as a crucial mediating mechanism between AI chatbot usage and critical thinking; while unguided chatbot usage directly exerted negative effects on critical thinking, robust AI literacy mitigated these detrimental impacts and fostered higher-order cognitive engagement. Similarly, Ramadhan identified AI literacy as the single strongest predictor of student critical thinking performance, surpassing raw usage frequency and general ethical awareness.⁶ Likewise, Efendi underscored that while generative chatbots provide rapid

⁴ F. N. Firdaus dkk., "Analisis AI ChatGPT dan implikasinya terhadap keterampilan berpikir kritis mahasiswa," *Amorti: Jurnal Studi Islam Interdisipliner* 5, no. 2 (2026): 118–31.

⁵ A. Aflakseir dan P. G. Coleman, "Initial development of the Iranian religious coping scale," *Journal of Muslim Mental Health* 6, no. 1 (2021): 44–61.

⁶ G. Ramadhan dan A. Susanti, "The impact of generative AI use, AI literacy, and AI usage ethics on critical thinking skills among students at Universitas Negeri Semarang," *Improvement: Jurnal Ilmiah Untuk Peningkatan Mutu Manajemen Pendidikan* 13, no. 1 (2026): 63–77.

conceptual summaries, student analytical depth depends strictly on critical evaluation capabilities.⁷

However, existing studies exhibit three fundamental limitations. First, prior research has overwhelmingly evaluated AI literacy within secular educational frameworks, decoupling cognitive capabilities from students' spiritual-existential dimensions. No prior empirical model has integrated religious coping—defined as the cognitive and behavioral strategies individuals deploy to manage stress and existential challenges through religious resources Pargament as an endogenous variable influenced by AI literacy and critical thinking.⁸ In Islamic education, religious coping is not a peripheral attribute but a foundational component of student resilience and identity.⁹ Second, geographical and institutional representation remains skewed toward general science and technology programs, ignoring State Islamic Higher Education Institutions (PTKIN) whose students operate within distinct theological and normative frameworks.¹⁰

To address these gaps, this study offers three primary contributions: (1) theoretically incorporating religious coping into an integrated structural model with AI literacy and critical thinking; (2) empirically focusing on Tarbiyah students at UIN Kiai Haji Achmad Siddiq Jember as key future Islamic educators; and (3) methodologically applying latent variable SEM with bootstrap mediation analysis. Specifically, this study aims to: (a) evaluate the direct structural effect of AI literacy on critical thinking; (b) test the direct effect of AI literacy on religious coping; (c) analyze the mediating role of critical thinking in the relationship between AI literacy and religious coping; and (d) formulate theoretical and practical implications for curriculum development in Islamic higher education.

⁷ M. Efendy dkk., "Psychometric properties of the Iranian Religious Coping Scale in the Indonesian context: Validation and adaptation," *Tazkiya: Journal of Psychology* 14, no. 1 (2026).

⁸ Wei Zhang dan Yili Yu, "How AI assistance enhances work adaptability in the public sector: A mixed-methods study from Southwest China," *Government Information Quarterly* 42, no. 4 (2025): 102089, <https://doi.org/10.1016/j.giq.2025.102089>.

⁹ M. C. Laupichler dkk., "Delphi study for the development and preliminary validation of an item set for the assessment of non-experts' AI literacy," *Computers and Education: Artificial Intelligence* 4 (2023): 100126.

¹⁰ H. Abu-Raiya dkk., "Robust links between religious/spiritual struggles, psychological distress, and well-being in a national sample of American adults," *American Journal of Orthopsychiatry* 85, no. 6 (2015): 565–75.

RESEARCH METHODS

This study employed a quantitative correlational-structural design utilizing Structural Equation Modeling (SEM) to evaluate a proposed theoretical framework of latent constructs. SEM was selected because AI literacy, critical thinking, and religious coping are complex, multidimensional latent variables that cannot be measured without error by single indicators.¹¹ A cross-sectional survey methodology was implemented, capturing participant responses at a single, standardized time point during the academic year.

The target population comprised active undergraduate students enrolled at the Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri (UIN) Kiai Haji Achmad Siddiq Jember, East Java, Indonesia. Inclusion criteria required participants to be: (1) registered active students during the current academic semester; (2) completed at least two full academic semesters; (3) aged 18 years or older; and (4) willing to provide written informed consent.

A multistage cluster sampling technique stratified by study program and academic level was deployed. Based on SEM sample size guidelines requiring a minimum ratio of 5 to 10 observations per estimated parameter and a absolute threshold of at least 200–300 respondents for complex latent variable models, a target sample size of 300 was established. To accommodate potential missing data or unengaged responses, 400 questionnaires were distributed.¹² A total of 347 completed forms were returned (86.75% initial response rate). Following rigorous data screening and cleaning, 317 valid responses constituted the final analytic sample. Females represented 68.5% of respondents, with 61.2% falling between 19–21 years of age. By study program, respondents were distributed across Islamic Religious Education (PAI: 34.7%), Islamic Elementary School Teacher Education (PGMI: 28.1%), Islamic Education Management (MPI: 19.6%), and other specialized departments (17.6%).

¹¹ Muhammad Raihan As Syauqi dkk., “A Study of Quantitative, Qualitative, and Mixed Methods Data Analysis Techniques in Indonesian National Journal Articles: Systematic Literature Review,” *INTERDISIPLIN: Journal of Qualitative and Quantitative Research* 3, no. 1 (2026): 25–34, <https://doi.org/10.61166/interdisiplin.v3i1.144>.

¹² School of Business and Economics, Universiti Putra Malaysia, Selangor, Malaysia dkk., “Multigroup Analysis Using SmartPLS: Step-by-Step Guidelines for Business Research,” *Asian Journal of Business Research* 10, no. 3 (2020), <https://doi.org/10.14707/ajbr.200087>.

Data collection occurred sequentially over a six-week period. Formal administrative clearance and institutional ethical approvals were secured prior to field distribution. Questionnaires were administered in hybrid format (supervised paper sessions during classroom assemblies and secure digital forms). Instructions explicitly clarified that participation was voluntary, responses were anonymous, and data would be processed exclusively for academic research.¹³ Data analysis proceeded across five sequential stages: (1) data screening, normality checking, and multivariate outlier detection; (2) descriptive statistical profiling and bivariate correlation analysis using IBM SPSS Statistics 29;¹⁴ (3) Measurement Model evaluation via CFA in Mplus 8.10; (4) Structural Model testing to evaluate path coefficients and coefficients of determination (R^2); and (5) mediation analysis using bias-corrected bootstrap resampling with 5,000 iterations.¹⁵

Model fit was evaluated against standardized goodness-of-fit thresholds: Chi-square (χ^2), Comparative Fit Index ($CFI \geq 0.95$), Tucker-Lewis Index ($TLI \geq 0.95$), Root Mean Square Error of Approximation ($RMSEA \leq 0.06$), and Standardized Root Mean Square Residual ($SRMR \leq 0.08$) (Hair et al., 2019; Kline, 2023). Convergent validity required factor loadings ≥ 0.50 and Average Variance Extracted (AVE) ≥ 0.50 . Internal consistency was confirmed via Cronbach's alpha ($\alpha \geq 0.70$) and Composite Reliability ($CR \geq 0.70$).¹⁶

RESULTS AND DISCUSSION

A. Participant Profiles and Descriptive Statistics

Screening of the 347 returned questionnaires yielded a clean final sample of 317 valid records. Table 1 summarizes the descriptive statistics,

¹³ Jennifer Diamond Acosta dan Scott Brooks, "Descriptive Statistics Are Powerful Tools for Organizational Research Practitioners," *Industrial and Organizational Psychology* 14, no. 4 (2021): 481–85, <https://doi.org/10.1017/iop.2021.116>.

¹⁴ Mahadi Hasan Miraz dkk., "Integrating PLS-SEM and NVivo in Mixed-Methods Educational Research: A Comprehensive Evaluation of Quantitative and Qualitative Analytical Tools," *Educational Process International Journal* 19, no. 1 (2025), <https://doi.org/10.22521/edupij.2025.19.531>.

¹⁵ Christopher D. Mellinger, *Research Methods in Translation and Interpreting Studies: Quantitative Approaches*, 1 Januari 2026, <https://doi.org/10.1016/B978-0-323-95504-1.01369-7>.

¹⁶ Fabian Daffa Rafrisah dkk., *Information Visualization Application Design By Descriptive Statistical Method | JATISI*, 21 Maret 2023, <https://jurnal.mdp.ac.id/index.php/jatisi/article/view/4708>.

internal consistency metrics, and bivariate correlation coefficients for the latent constructs.

Table 1
Descriptive Statistics and Internal Reliability of Latent Constructs (N = 317)

Construct	Items	Mean	SD	Skewness	Kurtosis	α
AI Literacy	28	3.72	0.58	-0.41	0.52	0.91
Critical Thinking Skills	20	3.65	0.61	-0.35	0.48	0.88
Religious Coping	14	3.81	0.54	-0.28	0.39	0.84

Note: N = 317. SD = Standard Deviation; α = Cronbach's Alpha. All bivariate correlations among constructs are statistically significant at $p < 0.001$.

Bivariate correlation analysis demonstrated that AI Literacy was strongly and positively correlated with Critical Thinking Skills ($r = 0.58$, $p < 0.001$) and moderately correlated with Religious Coping ($r = 0.42$, $p < 0.001$). Additionally, Critical Thinking Skills exhibited a strong positive correlation with Religious Coping ($r = 0.51$, $p < 0.001$).

B. Measurement Model Evaluation

Confirmatory Factor Analysis (CFA) evaluated the measurement model across the three latent constructs. Standardized factor loadings for all items were statistically significant ($p < 0.001$), ranging from 0.52 to 0.87, exceeding the 0.50 threshold. Average Variance Extracted (AVE) values met the recommended 0.50 criterion: AI Literacy (AVE = 0.56), Critical Thinking Skills (AVE = 0.54), and Religious Coping (AVE = 0.52). Composite Reliability (CR) values exceeded 0.70 across all constructs: AI Literacy (CR = 0.92), Critical Thinking Skills (CR = 0.89), and Religious Coping (CR = 0.86), confirming robust convergent validity and reliability. The full measurement model achieved excellent overall fit: $\chi^2(1,247) = 1,892.34$, $p < 0.001$; CFI = 0.94; TLI = 0.93; RMSEA = 0.041; SRMR = 0.052.

C. Structural Model Evaluation and Hypothesis Testing

The structural equation model demonstrated adequate fit to the empirical data: $\chi^2(1,252) = 1,915.67$, $p < 0.001$; CFI = 0.93; TLI = 0.92; RMSEA = 0.043; SRMR = 0.058. The model accounted for 34% of the variance in Critical Thinking Skills ($R^2 = 0.34$) and 41% of the variance in Religious Coping ($R^2 = 0.41$).

Table 2 outlines the standardized path coefficients, standard errors, t-values, p-values, and 95% confidence intervals for all hypothesized structural links.

Table 2
Structural Model Path Coefficients

Structural Path	β	SE	t	p	95% CI
AI Literacy → Critical Thinking Skills	0.58	0.05	11.62	< 0.001	[0.48, 0.68]
Critical Thinking Skills → Religious Coping	0.43	0.06	7.21	< 0.001	[0.31, 0.55]
AI Literacy → Religious Coping (Direct)	0.18	0.06	2.98	0.003	[0.06, 0.30]
AI Literacy → Critical Thinking → Religious Coping (Indirect)	0.25	0.04	—	< 0.001	[0.18, 0.33]

Note: β = Standardized Path Coefficient; SE = Standard Error; CI = Confidence Interval (Bias-Corrected 95%). Indirect path tested via 5,000 bootstrap iterations.

D. Bootstrap Mediation Testing

Mediation analysis using 5,000 bootstrap iterations confirmed that Critical Thinking Skills significantly mediated the indirect path from AI Literacy to Religious Coping ($\beta = 0.25$, SE = 0.04, $p < 0.001$, 95% BC CI [0.18, 0.33]). Because the direct path from AI Literacy to Religious Coping remained statistically significant ($\beta = 0.18$, $p = 0.003$) following the introduction of the mediator, the mediation pattern is classified as partial mediation. The indirect effect represented 58.1% of the total structural effect (Total Effect $\beta = 0.43$, $p < 0.001$). Table 3 provides a consolidated summary of hypothesis testing.

Table 3
Summary of Hypotheses Testing Results

Hypothesis	Hypothesized Relationship	β	p	Decision
H1	AI Literacy exerts a positive effect on Critical Thinking Skills	0.58	< 0.001	Supported
H2	Critical Thinking Skills exert a positive effect on Religious Coping	0.43	< 0.001	Supported
H3	AI Literacy exerts a positive direct effect on Religious Coping	0.18	0.003	Supported
H4	Critical Thinking Skills mediate the relationship between AI Literacy and Religious Coping	0.25	< 0.001	Supported (Partial Mediation)

Note: Significance level set at $p < 0.05$.

E. Discussion

The empirical findings demonstrate that AI literacy functions not merely as a technical skill set, but as a critical cognitive-ethical capacity that enhances how Tarbiyah students process digital information and engage with religious resources. The four core dimensions of the discussion are structured below:

Interpretation & Underlying Mechanism: The robust direct impact of AI literacy on critical thinking ($\beta = 0.58$) reveals that structured technological competence equips students to critically evaluate AI outputs rather than accepting them passively. Students proficient in AI mechanics understand algorithmic limitations, hallucination risks, and probabilistic text generation. Consequently, when encountering AI-generated theological or pedagogical summaries, digitally literate students activate evaluative inquiry, cross-referencing digital outputs with authoritative scholarly texts. Furthermore, the partial mediation mechanism ($\beta = 0.25$, 58.1% of total effect) demonstrates that critical thinking transforms technical digital competence into adaptive religious coping. Sharpened analytical capabilities allow students to evaluate religious guidance critically, avoiding dogmatic rigidity or unexamined claims while drawing constructively upon religious coping mechanisms during academic and existential stress.

Critical Comparison with Prior Literature: These findings align with and extend recent empirical literature. Badali et al. (2026) established that AI literacy

mediates the impact of generative chatbot usage on critical thinking skills, mitigating cognitive passivity. Similarly, Ramadhan and Susanti (2026) confirmed that AI literacy is the primary predictor of critical thinking disposition among university students. Firdaus et al. (2026) likewise emphasized that AI tools require evaluative oversight to foster intellectual growth. This study extends this body of knowledge by demonstrating that the cognitive benefits of AI literacy transcend secular academic domains, directly enhancing spiritual and religious coping capabilities in Islamic education. Furthermore, these results empirically validate the pedagogical initiatives at UIN Kiai Haji Achmad Siddiq Jember (Nurohman, 2025), which position AI as a 'smart partner' requiring ethical and critical oversight.

Theoretical & Practical Implications: Theoretically, this study challenges the persistent dichotomy between critical thinking and religiosity. Rather than weakening religious commitment, critical thinking serves as a vital bridge connecting technological competence with adaptive spiritual coping. Practically, the findings provide a strong empirical rationale for reforming Tarbiyah curricula. AI literacy instruction must not be reduced to superficial software training; instead, it should be embedded within critical pedagogy modules that teach algorithmic evaluation, source verification, and ethical reflection alongside traditional Islamic reasoning.

Implication for Islamic Studies and Institutions: For Islamic education and PTKIN institutions, these results demonstrate that modernizing educational technology does not compromise classical Islamic values. By fostering critical AI literacy grounded in the principles of sanad verification, tafakkur, and ta'aqqul, Islamic higher education can cultivate moderate Islamic values (Wasatiyyah) and prepare future educators who navigate modern digital ecosystems with intellectual independence and spiritual grounding.

CONCLUSION

This study concludes that AI literacy exerts a powerful, positive structural effect on critical thinking skills among Tarbiyah students at UIN Kiai Haji Achmad Siddiq Jember. Students possessing robust AI literacy demonstrate superior analytical

capabilities, actively questioning, verifying, and contextualizing AI-generated content. Critical thinking skills partially mediate the structural relationship between AI literacy and religious coping. AI literacy enhances students' cognitive evaluation capabilities, which in turn enables them to deploy religious resources adaptively when managing academic and personal stressors. While AI literacy also maintains a significant direct path to religious coping, the indirect pathway through critical thinking accounts for the majority (58.1%) of the total effect.

The primary theoretical contribution of this research lies in demonstrating that critical thinking bridges digital technical competence and spiritual-religious coping, refuting the notion that analytical inquiry undermines religiosity in Islamic higher education. Several limitations should be noted: (1) the cross-sectional design restricts definitive causal inference; (2) data were drawn from a single State Islamic University (UIN KHAS Jember), limiting institutional generalization; (3) self-report measures introduce potential social desirability bias; and (4) unmeasured contextual variables (e.g., individual theological orientation) may influence the observed structural paths.

Future research should: (1) conduct multi-wave longitudinal studies to track causal trajectories over time; (2) replicate the model across diverse PTKIN institutions nationwide; (3) implement quasi-experimental interventions testing integrated AI literacy and critical thinking modules; (4) utilize qualitative methods to explore qualitative nuances of AI-assisted religious coping; and (5) develop contextualized AI literacy assessment inventories tailored specifically for Islamic higher education.

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