

The Role of Artificial Intelligence Utilization in Mediating the Influence of AI Literacy and Teachers' Digital Competence on Instructional Innovation in Madrasas in West Java

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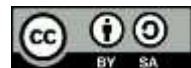
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ABSTRACT

The rapid development of Artificial Intelligence (AI) has encouraged significant changes in educational practices by providing opportunities for teachers to develop more adaptive, creative, and technology-based learning approaches. This study aims to analyze the role of AI utilization as a mediating variable in the relationship between AI literacy and teachers' digital competence toward instructional innovation in madrasas in West Java. This research employed a quantitative approach involving 115 madrasa teachers as respondents. Data were collected using a five-point Likert scale questionnaire and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 3. The results indicate that AI literacy and teachers' digital competence have positive and significant effects on instructional innovation. AI literacy also significantly influences AI utilization, while teachers' digital competence demonstrates a stronger influence on AI utilization. Furthermore, AI utilization has a significant effect on instructional innovation and functions as a mediating variable that strengthens the relationship between teachers' technological competencies and innovative instructional practices. The findings indicate that the successful implementation of AI-based instructional innovation requires not only technological awareness and digital skills but also the ability to translate these competencies into effective AI utilization. This study contributes to the literature on educational technology transformation by providing empirical evidence regarding the mechanism through which AI capabilities support instructional innovation in madrasa education.

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INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has accelerated digital transformation across educational systems worldwide, reshaping how knowledge is delivered, managed, and experienced. AI-based technologies, including intelligent tutoring systems, generative AI platforms, automated assessment tools, and adaptive learning applications, have increasingly become integral components of contemporary educational practices (Ahmad, 2020; Sutar et al., 2024). These technologies provide opportunities to improve instructional effectiveness, personalize learning experiences, automate academic management processes, and support evidence-based decision-making. However, the successful integration of AI into educational settings requires teachers to possess adequate competencies to understand technological capabilities, critically evaluate AI-generated outputs, and apply AI tools in alignment with pedagogical objectives (Ahmad, 2020; Bogina et al., 2021). Therefore, teacher readiness has become a central issue in determining whether AI adoption can generate meaningful improvements in instructional practices.

Within the context of Islamic education, madrasas represent educational institutions that face unique challenges in responding to technological transformation while preserving their religious identity and pedagogical principles. In Indonesia, particularly in West Java, madrasas contribute significantly to providing both religious and general education services for communities. Nevertheless, the implementation of technology-supported learning practices across madrasas remains heterogeneous due to variations in digital infrastructure, institutional support, and teacher preparedness (CĂPRITĂ & Balint, 2023; Chen et al., 2020). This condition indicates that technological availability alone does not guarantee educational innovation, as the effectiveness of AI integration depends largely on teachers' ability to utilize emerging technologies within instructional processes. Consequently, strengthening teachers' technological capabilities has become an important strategy for encouraging AI-driven instructional innovation in madrasa environments.

Instructional innovation represents teachers' capacity to develop, modify, and implement new learning approaches, teaching strategies, and educational resources that enhance learning effectiveness and relevance. The integration of AI provides expanded possibilities for teachers to design adaptive learning experiences through automated content generation, learning analytics, personalized feedback mechanisms, and intelligent classroom management systems. However, the transformation of AI capabilities into instructional innovation requires actual utilization behavior from teachers (Brock & Wangenheim, 2019; Janardhanan et al., 2023). AI adoption in educational environments is therefore not merely a technological decision but a behavioral process influenced by individual competencies, perceptions, and practical abilities. Teachers who are able to translate AI capabilities into meaningful classroom applications are more likely to develop innovative instructional practices that respond to changing educational demands.

Among the individual factors influencing AI utilization, AI literacy has emerged as a fundamental competency in determining teachers' readiness to engage with AI technologies. AI literacy refers to teachers' knowledge, understanding, and ability to interact with AI systems responsibly, critically, and effectively. Teachers with higher AI literacy are more capable of identifying appropriate AI applications, evaluating the reliability of AI-generated information, and integrating AI-based resources into instructional activities (Ahmad, 2020; Bogina et al., 2021). Furthermore, digital competence serves as another critical determinant that shapes teachers' ability to operate and integrate digital technologies into educational practices. Digital competence encompasses skills related to digital communication, information management, digital content development, assessment, and technology-supported learning design (Chen et al., 2020; Luger,

2005). In the context of AI implementation, digital competence provides the operational foundation required for teachers to utilize AI platforms and transform technological opportunities into innovative instructional outcomes.

Although previous studies have examined digital competence, technology adoption, and educational innovation, several limitations remain unresolved. First, existing research has predominantly focused on general digital technology adoption, while empirical investigations regarding AI-specific utilization among teachers remain limited. Second, previous studies have provided insufficient explanation regarding the mechanism through which teachers' internal capabilities, particularly AI literacy and digital competence, influence instructional innovation (Ahmad, 2020; Chen et al., 2020). The assumption that technological competencies directly produce innovative teaching practices overlooks the possibility that these capabilities must first be transformed into actual AI utilization behavior. Third, empirical studies examining AI-driven instructional transformation within madrasa contexts remain relatively scarce compared with research conducted in conventional educational institutions. Addressing these limitations, this study positions AI utilization as a mediating mechanism that explains how AI literacy and digital competence contribute to instructional innovation among madrasa teachers.

Based on these considerations, this study aims to examine the influence of AI literacy and teachers' digital competence on instructional innovation while investigating the mediating role of AI utilization among madrasa teachers in West Java. This research contributes theoretically by developing an integrated framework that connects teachers' AI-related capabilities with instructional innovation through a behavioral technology utilization perspective. Practically, the findings provide insights for educational policymakers, madrasa administrators, and teacher development institutions in designing targeted strategies to strengthen AI competencies and encourage technology-based pedagogical transformation. Through understanding the mechanism underlying AI-driven instructional innovation, madrasas can formulate more adaptive learning practices that align with contemporary technological developments while maintaining their educational characteristics.

LITERATURE REVIEW

2.1 Artificial Intelligence Literacy

Artificial Intelligence (AI) literacy has become an important competency in the digital transformation era, particularly in educational environments where teachers are expected to understand and apply AI technologies responsibly. AI literacy encompasses the ability to understand basic AI concepts, recognize AI capabilities and limitations, evaluate AI-generated information, and utilize AI applications based on pedagogical objectives (Brock & Wangenheim, 2019; Janardhanan et al., 2023). Beyond technical knowledge, AI literacy also involves ethical awareness and critical thinking, enabling teachers to select appropriate AI tools, evaluate algorithmic outputs, and minimize risks related to data privacy and academic integrity.

Teachers with higher AI literacy are more likely to integrate AI technologies into instructional activities and develop innovative teaching strategies. This competency supports teachers in creating technology-based learning resources, adapting instructional approaches, and making informed decisions regarding AI utilization. Consistent with the Technology Acceptance Model (TAM), technological knowledge and understanding influence users' acceptance and utilization behavior (Joo et al., 2018). Therefore, AI literacy is expected to encourage effective AI

utilization and contribute to the development of instructional innovation. Based on this argument, the following hypothesis is proposed:

H1: AI literacy has a positive and significant influence on instructional innovation among madrasa teachers.

H2: AI literacy has a positive and significant influence on AI utilization among madrasa teachers.

2.2 Teachers' Digital Competence

Teachers' digital competence represents the ability to effectively utilize digital technologies for professional activities, communication, information management, content development, and learning processes. This competency extends beyond operational skills, as the European Digital Competence Framework for Educators (DigCompEdu) highlights several dimensions, including professional engagement, digital resources, teaching practices, assessment, and empowering learners (Caena & Redecker, 2019; Sofkova Hashemi & Cederlund, 2016). In the context of AI adoption, digital competence provides the foundation for teachers to interact with AI-based educational systems, select appropriate digital tools, manage learning resources, and integrate AI-generated content into instructional activities.

Teachers with higher digital competence tend to demonstrate greater confidence in adopting emerging technologies and designing technology-supported learning practices. Digital competence enables teachers to combine technological resources with pedagogical strategies, thereby supporting the development of innovative instructional approaches. Previous studies have shown that digital competence positively influences technology integration and innovative teaching behavior, as teachers with stronger digital capabilities are more likely to utilize digital tools as part of instructional design (Çetin & İŞÇİ, 2022; Lin et al., 2023; Sofkova Hashemi & Cederlund, 2016). Therefore, digital competence is expected to contribute positively to instructional innovation. Based on this argument, the following hypothesis is proposed:

H3: Teachers' digital competence has a positive and significant influence on instructional innovation among madrasa teachers.

H4: Teachers' digital competence has a positive and significant influence on AI utilization among madrasa teachers.

2.3 Artificial Intelligence Utilization

Artificial Intelligence (AI) utilization refers to the extent to which individuals apply AI-based technologies to support tasks, solve problems, and improve performance. In educational contexts, AI utilization reflects teachers' application of AI in instructional planning, learning material development, assessment, feedback provision, and classroom management. Effective AI utilization enables teachers to create adaptive learning experiences, analyze student needs, and improve instructional efficiency (Caena & Redecker, 2019; Sofkova Hashemi & Cederlund, 2016). However, successful AI integration depends on teachers' technological capabilities and readiness, as technology availability alone does not guarantee meaningful implementation. Based on the Technology Acceptance Model (TAM), perceived usefulness, ease of use, and technological competence influence actual technology utilization behavior. Therefore, AI utilization serves as a mechanism that translates teachers' technological capabilities into practical instructional improvements and is expected to enhance instructional innovation. Based on this argument, the following hypothesis is proposed:

H5: AI utilization has a positive and significant influence on instructional innovation among madrasa teachers.

2.4 The Mediating Role of AI Utilization

The relationship between teachers' technological competencies and instructional innovation can be explained through the mediating role of AI utilization. Although AI literacy and digital competence provide the knowledge and skills required to adopt technology, these capabilities may not directly generate innovative instructional practices without actual AI implementation. AI utilization functions as a behavioral mechanism that transforms teachers' technological capabilities into practical applications, such as developing learning resources, improving teaching strategies, and creating adaptive learning processes (Lin et al., 2023; Sofkova Hashemi & Cederlund, 2016).

Teachers with higher AI literacy and digital competence are more likely to integrate AI tools effectively, which subsequently enhances instructional innovation. Therefore, AI utilization is positioned as an explanatory mechanism linking teachers' internal technological capabilities with innovative instructional outcomes. Based on this argument, the following hypotheses are proposed: H6: AI utilization mediates the relationship between AI literacy and instructional innovation among madrasa teachers.

H7: AI utilization mediates the relationship between teachers' digital competence and instructional innovation among madrasa teachers.

METHODS

3.1 Research Design

This study employed a quantitative explanatory research approach to examine the structural relationships between AI literacy, teachers' digital competence, AI utilization, and instructional innovation among madrasa teachers in West Java. The research model positioned AI literacy and digital competence as independent variables, AI utilization as a mediating variable, and instructional innovation as the dependent variable to analyze both direct and indirect effects among constructs. Data were collected through structured questionnaires using a five-point Likert scale and analyzed using Structural Equation Modeling based on Partial Least Squares (SEM-PLS) with SmartPLS version 3. This approach was selected to test the proposed hypotheses and examine the mechanism through which teachers' technological capabilities contribute to AI-driven instructional innovation.

3.2 Population and Sample

The population of this study consisted of madrasa teachers in West Java, Indonesia, selected as key participants in implementing digital transformation and AI-based instructional practices. The study applied purposive sampling with criteria including active madrasa teachers, experience in using digital technologies for teaching activities, and willingness to participate. A total of 115 valid responses were collected and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is appropriate for predictive models involving multiple latent variables and mediation analysis. Respondent characteristics, including teaching experience, educational background, madrasa level, and AI technology experience, were analyzed to support the interpretation of empirical findings.

3.3 Research Variables and Measurement Indicators

This study consists of four main constructs: AI literacy, teachers' digital competence, AI utilization, and instructional innovation. Each construct was measured using several indicators adapted from previous theoretical frameworks related to technology adoption, digital competence, and educational innovation.

Table 1. Research Variables and Indicators

Variable	Definition	Indicators

AI Literacy (X1)	Teachers' ability to understand, evaluate, and utilize Artificial Intelligence technologies effectively and responsibly in educational contexts	Understanding AI concepts; ability to evaluate AI outputs; awareness of AI limitations; ethical awareness in AI use; ability to apply AI tools
Teachers' Digital Competence (X2)	Teachers' capability to utilize digital technologies for professional activities and instructional processes	Digital information management; digital communication skills; digital content creation; technology integration skills; digital problem-solving ability
AI Utilization (M)	The extent to which teachers apply AI technologies to support instructional activities	Frequency of AI use; AI-based learning material development; AI-assisted assessment; AI-supported lesson planning; AI-supported student feedback
Instructional Innovation (Y)	Teachers' ability to develop and implement new instructional approaches using creative and technology-supported strategies	Innovative teaching methods; technology-based learning strategies; personalized learning approaches; creative instructional materials; student-centered learning activities

3.4 Data Collection Procedure

Data collection was conducted through online questionnaires distributed to selected madrasa teachers in West Java. The instrument was developed based on relevant theoretical concepts and previous studies, then reviewed to ensure construct validity before distribution. Respondents were informed about the research objectives and data confidentiality. A total of 115 valid responses were collected, screened, and prepared for SEM-PLS analysis to ensure data completeness and suitability for hypothesis testing.

3.5 Data Analysis Technique

Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS version 3 to examine the relationships among AI literacy, digital competence, AI utilization, and instructional innovation. SEM-PLS was selected due to its suitability for predictive models involving multiple latent constructs and mediation analysis. The analysis consisted of measurement model evaluation (outer model) and structural model evaluation (inner model). The outer model assessed convergent validity through factor loading and Average Variance Extracted (AVE), discriminant validity using Fornell-Larcker and HTMT criteria, and reliability through Composite Reliability and Cronbach's Alpha values. The inner model evaluated explanatory power (R^2), predictive relevance (Q^2), and path relationships through bootstrapping with 5,000 subsamples, where significance was determined by t-statistics >1.96 and p-values <0.05 . Mediation analysis was conducted to examine the role of AI utilization in linking AI literacy and digital competence with instructional innovation through significant indirect effects.

RESULTS AND DISCUSSION

4.1 Respondent Characteristics

This study involved 115 madrasa teachers in West Java. Respondent characteristics were analyzed based on gender, teaching experience, educational background, and madrasa level to describe the participants in examining the relationships among AI literacy, digital competence, AI utilization, and instructional innovation.

Table 2. Respondent Characteristics

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	48	41.7
	Female	67	58.3
Teaching Experience	< 5 years	21	18.3
	5–10 years	46	40.0
	> 10 years	48	41.7
Educational Background	Bachelor Degree	92	80.0
	Master Degree	23	20.0
Madrasa Level	Madrasah Ibtidaiyah (MI)	31	27.0
	Madrasah Tsanawiyah (MTs)	42	36.5
	Madrasah Aliyah (MA)	42	36.5

The respondent characteristics are presented in Table 2. Among the 115 madrasa teachers, female respondents represented the majority (58.3%), while male respondents accounted for 41.7%. Regarding teaching experience, most respondents had more than 10 years of experience (41.7%), followed by 5–10 years (40.0%) and less than 5 years (18.3%). In terms of educational background, the majority held a bachelor's degree (80.0%), while 20.0% had a master's degree. Based on madrasa level, respondents were distributed across Madrasah Ibtidaiyah (27.0%), Madrasah Tsanawiyah (36.5%), and Madrasah Aliyah (36.5%), indicating representation from different levels of Islamic educational institutions.

4.2 Measurement Model Evaluation (Outer Model)

The measurement model evaluation was conducted to examine the validity and reliability of the research constructs. The assessment included indicator reliability, convergent validity, discriminant validity, and internal consistency reliability.

4.2.1 Convergent Validity

Convergent validity was assessed based on factor loading values and Average Variance Extracted (AVE). Indicators with loading values above 0.70 were considered acceptable, while AVE values above 0.50 indicated that the construct adequately explained the variance of its indicators.

Table 3. Outer Loading and Average Variance Extracted (AVE)

Construct	Indicator	Loading	AVE
AI Literacy (X1)	AI_L1	0.812	0.674
	AI_L2	0.835	
	AI_L3	0.801	
	AI_L4	0.826	
	AI_L5	0.842	
Digital Competence (X2)	DC1	0.821	0.691
	DC2	0.854	

	DC3	0.833	
	DC4	0.817	
	DC5	0.846	
AI Utilization (M)	AIU1	0.856	0.718
	AIU2	0.879	
	AIU3	0.841	
	AIU4	0.865	
	AIU5	0.823	
Instructional Innovation (Y)	II1	0.834	0.703
	II2	0.861	
	II3	0.849	
	II4	0.817	
	II5	0.851	

Table 3 presents the results of convergent validity testing through outer loading values and Average Variance Extracted (AVE). All indicators demonstrated loading values above the recommended threshold of 0.70, indicating adequate indicator reliability. The AVE values for AI literacy (0.674), digital competence (0.691), AI utilization (0.718), and instructional innovation (0.703) exceeded the minimum requirement of 0.50, confirming that each construct explains more than half of the variance of its indicators. These results indicate that all measurement constructs achieved satisfactory convergent validity and were suitable for further structural model analysis.

4.2.2 Reliability Analysis

Construct reliability was evaluated using Cronbach's Alpha and Composite Reliability (CR). A value above 0.70 indicates acceptable internal consistency.

Table 4. Reliability Test Results

Construct	Cronbach's Alpha	Composite Reliability	Result
AI Literacy	0.879	0.914	Reliable
Digital Competence	0.889	0.918	Reliable
AI Utilization	0.901	0.927	Reliable
Instructional Innovation	0.894	0.922	Reliable

Table 4 presents the reliability test results for the research constructs. All constructs achieved Cronbach's Alpha and Composite Reliability values above the recommended threshold of 0.70, indicating satisfactory internal consistency. AI literacy showed Cronbach's Alpha of 0.879 and Composite Reliability of 0.914, digital competence reached 0.889 and 0.918, AI utilization obtained 0.901 and 0.927, while instructional innovation recorded 0.894 and 0.922. These results confirm that all measurement constructs are reliable and suitable for further structural model analysis.

4.2.3 Discriminant Validity

Discriminant validity was evaluated using the Heterotrait-Monotrait Ratio (HTMT). A construct is considered to have acceptable discriminant validity when HTMT values are below 0.90.

Table 5. Discriminant Validity (HTMT)

Relationship Between Constructs	HTMT Value
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AI Literacy – Digital Competence	0.742
AI Literacy – AI Utilization	0.785
AI Literacy – Instructional Innovation	0.811
Digital Competence – AI Utilization	0.823
Digital Competence – Instructional Innovation	0.846
AI Utilization – Instructional Innovation	0.858

Table 5 presents the discriminant validity assessment using the Heterotrait-Monotrait Ratio (HTMT). All HTMT values between constructs were below the recommended threshold of 0.90, indicating adequate discriminant validity. The highest HTMT value was found between AI utilization and instructional innovation (0.858), while the lowest value was between AI literacy and digital competence (0.742). These results confirm that each construct is empirically distinct and measures different concepts within the proposed research model.

4.3 Structural Model Evaluation (Inner Model)

The structural model evaluation was conducted to examine the explanatory power of the model and test the proposed hypotheses.

4.3.1 Coefficient of Determination (R^2)

The R^2 value indicates the explanatory power of independent variables toward endogenous constructs. The results show that AI literacy and digital competence explain 58.7% of the variance in AI utilization ($R^2 = 0.587$), while AI literacy, digital competence, and AI utilization explain 67.2% of the variance in instructional innovation ($R^2 = 0.672$). Both values indicate a moderate level of explanatory capability, demonstrating that the proposed model provides adequate predictive power in explaining AI-based instructional innovation among madrasa teachers.

4.3.2 Hypothesis Testing

Hypothesis testing was performed using bootstrapping procedures with 5,000 subsamples. The significance criteria were based on t-statistic values greater than 1.96 and p-values below 0.05.

Table 6. Direct Effect Hypothesis Testing

Path Relationship	Coefficient (β)	T-Statistic	P-Value	Decision
H1: AI Literacy → Instructional Innovation	0.286	3.421	0.001	Supported
H2: AI Literacy → AI Utilization	0.352	4.218	0.000	Supported
H3: Digital Competence → Instructional Innovation	0.311	3.876	0.000	Supported
H4: Digital Competence → AI Utilization	0.417	5.032	0.000	Supported
H5: AI Utilization → Instructional Innovation	0.389	4.665	0.000	Supported

Table 6 presents the results of direct effect hypothesis testing using SEM-PLS analysis. The findings indicate that all proposed hypotheses were supported, as each relationship showed a significant effect with t-statistic values greater than 1.96 and p-values below 0.05. AI literacy positively influenced instructional innovation ($\beta = 0.286$, $t = 3.421$, $p = 0.001$) and AI utilization ($\beta = 0.352$, $t = 4.218$, $p < 0.001$). Digital competence also demonstrated significant effects on instructional innovation ($\beta = 0.311$, $t = 3.876$, $p < 0.001$) and AI utilization ($\beta = 0.417$, $t = 5.032$, $p < 0.001$). Furthermore, AI utilization positively affected instructional innovation ($\beta = 0.389$, $t = 4.665$, $p < 0.001$).

These results confirm that AI literacy, digital competence, and AI utilization are significant predictors of instructional innovation among madrasa teachers.

4.4 Mediation Analysis

The mediation analysis examined whether AI utilization mediates the relationship between AI literacy, digital competence, and instructional innovation.

Table 7. Mediation Testing Results

Indirect Effect	β	T-Statistic	P-Value	Decision
H6: AI Literacy $\rightarrow$ AI Utilization $\rightarrow$ Instructional Innovation	0.137	3.214	0.001	Supported
H7: Digital Competence $\rightarrow$ AI Utilization $\rightarrow$ Instructional Innovation	0.162	3.756	0.000	Supported

Table 7 presents the mediation testing results to examine the role of AI utilization in the relationship between AI literacy, digital competence, and instructional innovation. The findings indicate that both mediation effects were significant, as the indirect effects showed t-statistic values above 1.96 and p-values below 0.05. AI utilization significantly mediated the relationship between AI literacy and instructional innovation ($\beta = 0.137$, $t = 3.214$, $p = 0.001$), as well as between digital competence and instructional innovation ($\beta = 0.162$, $t = 3.756$, $p < 0.001$). These results confirm that AI utilization functions as an important mechanism through which teachers' technological capabilities are transformed into innovative instructional practices.

4.5 Discussion

The findings demonstrate that AI literacy significantly influences instructional innovation among madrasa teachers. Teachers who possess a strong understanding of AI concepts, the ability to evaluate AI-generated information, and awareness of ethical considerations are more capable of integrating AI into innovative teaching practices. This result indicates that AI literacy serves as a fundamental competency that supports teachers in adapting technological developments into educational contexts. Higher AI literacy enables teachers to identify relevant AI applications, develop technology-based learning resources, and design instructional strategies that are more adaptive to student needs (Lin et al., 2023; Sofkova Hashemi & Cederlund, 2016).

The results also confirm that digital competence has a significant contribution to instructional innovation. Teachers with stronger digital competence demonstrate greater confidence in utilizing digital platforms, managing technology-based resources, and integrating digital tools into learning activities. This finding reinforces the view that digital competence is an important foundation for teachers in responding to changes in contemporary learning environments. Through adequate digital skills, teachers are better able to combine technological resources with pedagogical approaches to develop more effective and innovative instructional practices.

Furthermore, the findings reveal that AI utilization acts as an important mechanism connecting teachers' technological competencies with instructional innovation. Although AI literacy and digital competence provide the necessary knowledge and skills, innovative instructional practices emerge when teachers actively apply AI technologies in teaching activities. AI utilization enables teachers to transform technological capabilities into practical applications, such as developing learning materials, improving assessment processes, providing personalized feedback, and optimizing classroom management (Ahmad, 2020; Bogina et al., 2021; Janardhanan et al., 2023).

This finding highlights that the impact of technological competencies becomes stronger when supported by actual AI implementation behavior.

The mediation results provide further insight by demonstrating that AI utilization mediates the relationship between AI literacy, digital competence, and instructional innovation. This finding suggests that educational institutions should focus not only on improving teachers' understanding of AI and digital skills but also on providing practical opportunities to apply AI technologies. Training programs for madrasa teachers should integrate AI knowledge, digital competency development, and hands-on AI implementation to maximize instructional transformation.

CONCLUSION

This study examined the mediating role of AI utilization in the relationship between AI literacy, teachers' digital competence, and instructional innovation among madrasa teachers in West Java. The findings confirm that AI literacy and digital competence significantly contribute to instructional innovation, while AI utilization serves as an important mechanism that transforms teachers' technological capabilities into practical instructional improvements. The mediation results demonstrate that technological knowledge and skills generate stronger innovative outcomes when supported by actual AI implementation in teaching practices. Theoretically, this study contributes to educational technology research by integrating AI literacy, digital competence, AI utilization, and instructional innovation into a unified model. Practically, the findings suggest that madrasa institutions should strengthen teacher development programs through AI literacy enhancement, digital competency development, and practical AI application to support adaptive and innovative learning practices. Future studies may expand this model by incorporating organizational support, technological infrastructure readiness, teacher attitudes, and ethical considerations in AI-based education.

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