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## ORIGINAL RESEARCH ARTICLE

# Artificial Intelligence Readiness and Administrative Efficiency in Madrasahs: The Mediating Role of Digital Competence

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## ABSTRACT

The rapid development of Artificial Intelligence (AI) creates opportunities for madrasahs to improve administrative processes and institutional services. However, the benefits of AI depend on institutional readiness and the ability of educational personnel to utilize digital technologies effectively. This study aims to examine the effect of Artificial Intelligence Readiness on Administrative Efficiency in madrasahs and to investigate the mediating role of Digital Competence. A quantitative explanatory design was employed involving 78 respondents from madrasahs. Data were collected using a five-point Likert-scale questionnaire and analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM). The findings indicate that Artificial Intelligence Readiness has a positive and significant effect on Digital Competence ( $\beta = 0.292$ ;  $p = 0.009$ ). Artificial Intelligence Readiness also has a very strong and significant direct effect on Administrative Efficiency ( $\beta = 0.951$ ;  $p < 0.001$ ). The model explains 91.1% of the variance in Administrative Efficiency ( $R^2 = 0.911$ ). However, Digital Competence does not significantly affect Administrative Efficiency ( $\beta = 0.012$ ;  $p = 0.898$ ), and its mediating effect is not supported ( $\beta = 0.003$ ;  $p = 0.902$ ). These findings indicate that the contribution of AI readiness to administrative efficiency occurs predominantly through a direct institutional pathway rather than through digital competence. The study contributes to Islamic educational management by emphasizing institutional preparedness, technological infrastructure, organizational support, and AI integration as critical factors for improving administrative efficiency in madrasahs.

**Keywords:** Artificial Intelligence Readiness; Digital Competence; Administrative Efficiency; Madrasah; Islamic Educational Management.



## ABSTRAK

Perkembangan Artificial Intelligence (AI) membuka peluang bagi madrasah untuk meningkatkan proses administrasi dan layanan kelembagaan. Namun, manfaat AI sangat bergantung pada kesiapan institusi dan kemampuan tenaga pendidikan dalam memanfaatkan teknologi digital secara efektif. Penelitian ini bertujuan untuk menganalisis pengaruh Artificial Intelligence Readiness terhadap Administrative Efficiency pada madrasah serta menguji peran mediasi Digital Competence. Penelitian menggunakan pendekatan kuantitatif dengan desain eksplanatori yang melibatkan 78 responden dari madrasah. Data dikumpulkan menggunakan kuesioner skala Likert lima tingkat dan dianalisis dengan Partial Least Squares–Structural Equation Modeling (PLS-SEM). Hasil penelitian menunjukkan bahwa Artificial Intelligence Readiness berpengaruh positif dan signifikan terhadap Digital Competence ( $\beta = 0,292$ ;  $p = 0,009$ ). Artificial Intelligence Readiness juga memiliki pengaruh langsung yang sangat kuat dan signifikan terhadap Administrative Efficiency ( $\beta = 0,951$ ;  $p < 0,001$ ). Model mampu menjelaskan 91,1% variasi Administrative Efficiency ( $R^2 = 0,911$ ). Namun, Digital Competence tidak berpengaruh signifikan terhadap Administrative Efficiency ( $\beta = 0,012$ ;  $p = 0,898$ ), dan peran mediasinya juga tidak terbukti ( $\beta = 0,003$ ;  $p = 0,902$ ). Temuan ini menunjukkan bahwa kontribusi kesiapan AI terhadap efisiensi administrasi terutama berlangsung melalui jalur langsung pada tingkat institusional, bukan melalui kompetensi digital sebagai mediator. Penelitian ini memberikan kontribusi bagi manajemen pendidikan Islam dengan menegaskan pentingnya kesiapan kelembagaan, infrastruktur teknologi, dukungan organisasi, dan integrasi AI sebagai faktor utama dalam meningkatkan efisiensi administrasi madrasah.

**Kata Kunci:** Kesiapan Kecerdasan Buatan; Kompetensi Digital; Efisiensi Administratif; Madrasah; Manajemen Pendidikan Islam.

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## 1. INTRODUCTION

The 21st-century digital era has brought about significant transformations across various aspects of life, including education. Technological advances such as smartphones, the internet, educational software, and online learning platforms have created new challenges for educators. Teachers are no longer merely information transmitters but must also serve as facilitators, counselors, and lifelong learners. In the context of Islamic Religious Education (PAI), these demands are compounded by the necessity to integrate Islamic values with contemporary pedagogical approaches while maintaining the integrity of religious teachings in an increasingly complex educational landscape. Recent research by Zaqiah et al. (2024) emphasized that in-service teacher education programs are essential for improving the performance of PAI teachers and promoting internal quality assurance within teacher training institutes.

The rapid development of Artificial Intelligence (AI) has created new opportunities for educational institutions to improve administrative processes, decision-making, data management, and institutional services (Hadi et al., 2025; Mahmud et al., 2026; Raina et al., 2026). Madrasahs, as Islamic educational institutions, are also increasingly required to adapt to these technological developments (Haningsih et al., 2026; Sibawaihi et al., 2025; Suparman et al., 2025). AI can support various administrative activities, including data processing, document management,

information services, scheduling, reporting, and institutional communication (Dwi Novianti, 2026; Hadi et al., 2026; Kuswadi et al., 2026). However, the successful implementation of AI does not depend solely on the availability of technology. It requires institutional readiness, adequate infrastructure, supportive policies, human resources, and the ability of educational personnel to use digital technologies effectively.

One of the important outcomes expected from AI implementation is administrative efficiency (Fahmi Husein, Moh Solikul Hadi, 2024; Sibawaihi et al., 2025). Efficient administration enables madrasahs to reduce unnecessary workloads, accelerate information processing, minimize errors, improve data accessibility, and provide faster services to teachers, students, and other stakeholders (Moh. Solikul Hadi, M. Sayyidul Abrori, 2024). Nevertheless, AI readiness alone may not automatically result in administrative efficiency. Personnel need sufficient digital competence to understand, operate, evaluate, and appropriately integrate AI-supported technologies into their administrative work. Thus, digital competence may represent an important mechanism connecting institutional readiness for AI with actual improvements in administrative performance.

Previous studies have shown that organizational readiness for AI and digital technologies is associated with successful technology adoption and improved organizational performance (Ariyanto et al., 2026; Ichsan & Susanti, 2025). Research in educational settings has also highlighted the importance of digital competence in enabling teachers and educational staff to utilize emerging technologies effectively (Amin et al., 2025; Saidah & Fahmi, 2025). Other studies indicate that digital competence contributes to work efficiency, innovation, problem-solving, and the effective integration of digital systems into organizational processes. These findings suggest that both institutional readiness and individual digital capabilities are important components of successful digital transformation.

However, an important research gap remains. Previous research has generally examined AI readiness as a determinant of technology adoption or organizational performance, while digital competence has often been investigated as an independent factor influencing technology use and employee performance. Relatively limited research has examined Digital Competence as a mediating mechanism between Artificial Intelligence Readiness and Administrative Efficiency, particularly within the context of madrasahs. Moreover, much of the existing discussion concerning AI readiness focuses on higher education, business organizations, or general educational institutions, leaving the administrative context of Islamic educational institutions comparatively underexplored.

Based on this gap, this study aims to examine the effect of Artificial Intelligence Readiness on Administrative Efficiency in madrasahs and investigate the mediating role of Digital Competence. Specifically, the study seeks to determine whether institutional readiness for AI directly contributes to administrative efficiency and whether this relationship is strengthened through the digital competence of teachers and administrative personnel. The novelty of this study lies in developing an integrated mediation model that connects institutional AI readiness, individual digital competence, and administrative efficiency within the madrasah context. Rather than viewing AI readiness merely as technological preparedness, this study conceptualizes it as an institutional capability whose benefits depend partly on the competence of personnel who implement and utilize

AI-supported technologies. This perspective contributes to Islamic educational management literature by explaining how madrasahs can prepare for AI adoption while simultaneously strengthening human capabilities to achieve more efficient and effective administrative services.

## 2. RESEARCH METHODS

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This study employed a quantitative approach with an explanatory research design to examine the relationships between Artificial Intelligence Readiness, Digital Competence, and Administrative Efficiency in madrasahs (Gurbuz, n.d.; Stadtländer, 2009). The study focused on examining the direct effect of Artificial Intelligence Readiness on Administrative Efficiency and the indirect effect through Digital Competence as a mediating variable.

The population consisted of teachers and administrative personnel working in madrasahs (Creswell, 2018; Ponto J, 2015). Respondents were selected using purposive sampling, with the criteria that participants were actively involved in academic or administrative activities and had experience using digital technologies in their institutional work. Data were collected through a structured questionnaire using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The questionnaire measured three main constructs. Artificial Intelligence Readiness (AIR) was assessed through indicators related to institutional preparedness, technological infrastructure, organizational support, AI-related policies, and readiness of human resources to adopt AI. Digital Competence (DC) was measured through indicators related to digital information management, communication and collaboration, digital content and technology use, problem-solving, and responsible and secure use of digital technologies. Administrative Efficiency (AE) was measured through indicators concerning time efficiency, accuracy of administrative processes, reduction of workload, accessibility of information, service quality, and effectiveness of administrative procedures.

Data analysis was conducted using Partial Least Squares–Structural Equation Modeling (PLS-SEM) (Faizin et al., 2025; Hair et al., 2014). The analysis consisted of two stages. First, the measurement model (outer model) was evaluated to assess indicator reliability and construct validity. Indicator reliability was examined through outer loading values, while internal consistency was assessed using Cronbach's Alpha and Composite Reliability. Convergent validity was evaluated using the Average Variance Extracted (AVE), while discriminant validity was assessed using the Heterotrait–Monotrait (HTMT) ratio.

Second, the structural model (inner model) was evaluated to examine the hypothesized relationships among the constructs. The analysis included path coefficients ( $\beta$ ), coefficient of determination ( $R^2$ ), effect size ( $f^2$ ), predictive relevance ( $Q^2$ ), and Variance Inflation Factor (VIF). The significance of the hypothesized relationships was assessed using a bootstrapping procedure with 5,000 resamples, based on t-statistics and p-values. A relationship was considered statistically significant when the p-value was below 0.05.

The mediating role of Digital Competence was examined by testing the indirect relationship between Artificial Intelligence Readiness and Administrative Efficiency through Digital

Competence. The indirect effect was evaluated using bootstrapping by examining the indirect path coefficient, t-statistic, p-value, and confidence interval. Mediation was determined by comparing the significance of the direct and indirect effects.

The proposed structural model consisted of three main relationships: Artificial Intelligence Readiness → Digital Competence, Digital Competence → Administrative Efficiency, and Artificial Intelligence Readiness → Administrative Efficiency. The indirect pathway, Artificial Intelligence Readiness → Digital Competence → Administrative Efficiency, was subsequently tested to determine whether Digital Competence functions as a mediating mechanism.

This methodological design enables the study to explain not only whether madrasahs' readiness to adopt Artificial Intelligence contributes to administrative efficiency but also whether the availability of digital competence among educational personnel helps translate AI readiness into more efficient administrative practices.

### 3. RESULTS AND DISCUSSION

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The study involved 78 respondents from madrasahs. Three constructs were examined: Artificial Intelligence Readiness (AIR), Digital Competence (DC), and Administrative Efficiency (AE). The descriptive analysis shows that all three variables were perceived positively by respondents. Administrative Efficiency obtained the highest mean score (3.276), followed by Artificial Intelligence Readiness (3.272) and Digital Competence (3.256). These results indicate that respondents generally perceived their madrasahs as having a relatively positive level of AI readiness, digital competence, and administrative efficiency.

The correlation analysis reveals a strong relationship between Artificial Intelligence Readiness and Administrative Efficiency ( $r = 0.955$ ). In contrast, the relationship between Artificial Intelligence Readiness and Digital Competence is moderate ( $r = 0.292$ ), while Digital Competence and Administrative Efficiency have a relatively weak positive correlation ( $r = 0.290$ ).

This pattern suggests that administrative efficiency is much more strongly associated with AI readiness than with digital competence. Effect of Artificial Intelligence Readiness on Digital Competence. The first structural relationship indicates that Artificial Intelligence Readiness has a positive relationship with Digital Competence. The standardized path coefficient is approximately  $\beta = 0.292$ . The corresponding  $R^2$  value for Digital Competence is 0.085, indicating that Artificial Intelligence Readiness explains approximately 8.5% of the variance in Digital Competence.

The finding suggests that institutional readiness for AI may contribute to the development of personnel's digital capabilities. However, the relatively modest explanatory power also indicates that digital competence is influenced by other factors, such as training, professional experience, access to technology, individual motivation, organizational support, and opportunities for digital learning.

The relationship between Digital Competence and Administrative Efficiency is relatively weak after Artificial Intelligence Readiness is included in the structural model. The standardized path coefficient is approximately  $\beta = 0.012$ .

This result indicates that Digital Competence provides only a very small unique contribution to Administrative Efficiency within the complete model. Although the bivariate correlation between Digital Competence and Administrative Efficiency is positive ( $r = 0.290$ ), its contribution becomes negligible when Artificial Intelligence Readiness is simultaneously considered.

This finding suggests that having digitally competent personnel does not automatically guarantee higher administrative efficiency. The efficiency of madrasah administration may depend more strongly on the availability and integration of AI-based systems, institutional infrastructure, standardized procedures, management support, and the actual implementation of digital technologies. The strongest finding is the direct relationship between Artificial Intelligence Readiness and Administrative Efficiency. The standardized path coefficient is approximately  $\beta = 0.951$ , demonstrating a very strong positive relationship. The structural model produces an  $R^2$  value of 0.911 for Administrative Efficiency, meaning that approximately 91.1% of the variance in Administrative Efficiency can be explained by Artificial Intelligence Readiness and Digital Competence in the model. However, given the very small contribution of Digital Competence, the overwhelming proportion of this explanatory power is associated with Artificial Intelligence Readiness.

This result indicates that institutional readiness to adopt and utilize AI is strongly associated with more efficient administrative processes. Madrasahs that are better prepared in terms of technological infrastructure, institutional support, policies, and readiness to implement AI tend to demonstrate better administrative efficiency. The proposed mediation model assumes that Artificial Intelligence Readiness improves Administrative Efficiency indirectly through Digital Competence. Based on the structural coefficients, the estimated indirect effect is:  $\beta_{\text{indirect}} = 0.292 \times 0.012 \approx 0.003$

The indirect effect is therefore extremely small. Because the Digital Competence  $\rightarrow$  Administrative Efficiency relationship is not significant in the structural model, there is insufficient evidence that Digital Competence functions as a mediator. Thus, the proposed mediation relationship is not supported. The findings indicate that the contribution of Artificial Intelligence Readiness to Administrative Efficiency occurs predominantly through a direct pathway, rather than through Digital Competence as an intermediary mechanism.

Overall, the findings demonstrate that Artificial Intelligence Readiness is the dominant factor associated with Administrative Efficiency in the observed madrasahs. The very strong direct relationship indicates that institutional preparedness for AI including technological, organizational, and human-resource readiness is closely connected with the ability of madrasahs to conduct administrative activities efficiently.

At the same time, Digital Competence does not emerge as a significant mediator. Although AI readiness is positively associated with digital competence, the latter does not provide a meaningful additional contribution to administrative efficiency after AI readiness is taken into account. Therefore, the findings suggest that the effectiveness of AI implementation may depend more directly on the institution's overall readiness and integration of AI into administrative processes than on individual digital competence alone.

This finding provides an important basis for the discussion section because it supports the direct role of Artificial Intelligence Readiness in improving Administrative Efficiency but does not support the proposed mediating role of Digital Competence. The unexpected mediation result also provides an opportunity to develop the study's novelty by arguing that AI readiness should be understood as an institutional capability whose impact may be more immediate than the individual competence pathway.

The SEM-PLS results show that Artificial Intelligence Readiness (AIR) has a positive and significant effect on Digital Competence (DC) ( $\beta = 0.292$ ;  $p = 0.009$ ). AIR also has a very strong and significant direct effect on Administrative Efficiency (AE) ( $\beta = 0.951$ ;  $p < 0.001$ ). In contrast, Digital Competence does not significantly affect Administrative Efficiency, with  $\beta = 0.012$  and  $p = 0.898$ . The  $R^2$  value of 0.911 indicates that the model explains approximately 91.1% of the variance in Administrative Efficiency. Furthermore, the indirect effect of AIR on AE through DC is not significant ( $\beta = 0.003$ ;  $p = 0.902$ ), indicating that Digital Competence does not significantly mediate the relationship. Overall, the findings demonstrate that Artificial Intelligence Readiness contributes more directly to improving administrative efficiency in madrasahs than through Digital Competence as a mediating mechanism.

## Discussion

The findings demonstrate that Artificial Intelligence Readiness has a positive and significant effect on Digital Competence ( $\beta = 0.292$ ;  $p = 0.009$ ). This result indicates that madrasahs with stronger institutional preparedness for AI tend to have personnel with better digital capabilities. AI readiness, which includes technological infrastructure, organizational support, policies, and human-resource preparedness, can create an environment that encourages personnel to learn and utilize emerging technologies. This finding is consistent with the Technology–Organization–Environment (TOE) framework, which views technological readiness and organizational conditions as important foundations for successful technology adoption. Recent research also emphasizes that organizational AI readiness is multidimensional and depends on the alignment of technological capabilities, organizational structures, competencies, and environmental conditions. Thus, the present finding supports previous research by confirming that institutional readiness is associated with the development of digital capabilities.

The finding is also consistent with recent educational research emphasizing the relationship between digital competence and readiness for technological innovation. Studies in educational contexts indicate that digital competence is closely connected with educators' readiness to engage with emerging technologies and AI. Similarly, research involving educational administrators highlights that digital literacy, infrastructure, and policy frameworks are important components of institutional readiness for AI adoption. However, the relatively modest explanatory power of the present model ( $R^2 = 0.085$ ) indicates that AI readiness explains only 8.5% of the variation in Digital Competence. This suggests that digital competence cannot be developed through institutional readiness alone; professional training, individual experience, motivation, access to technology, and continuous professional development are also likely to play important roles.

A different pattern emerges in the relationship between Digital Competence and Administrative Efficiency. The structural path is very weak and statistically insignificant ( $\beta = 0.012$ ;  $p = 0.898$ ). This finding does not support the expectation that digitally competent personnel will automatically produce higher administrative efficiency. At the descriptive and correlational levels, Digital Competence is positively associated with Administrative Efficiency, but its unique contribution disappears when Artificial Intelligence Readiness is included in the structural model. This suggests that possessing digital skills may be insufficient unless those skills are supported by institutional systems, appropriate technologies, standardized administrative procedures, and organizational policies. Research on digital administration similarly indicates that improving digital competence requires practical training and appropriate technological systems to generate improvements in administrative work.

The strongest finding is the very strong positive effect of Artificial Intelligence Readiness on Administrative Efficiency ( $\beta = 0.951$ ;  $p < 0.001$ ). The  $R^2$  value of 0.911 indicates that the model explains approximately 91.1% of the variance in Administrative Efficiency. This finding strongly supports the argument that organizational preparedness is a critical foundation for realizing the practical benefits of AI in administrative processes. When madrasahs possess adequate infrastructure, institutional support, policies, and readiness to integrate AI, administrative activities can potentially become faster, more systematic, data-driven, and less dependent on repetitive manual processes. Recent research on AI readiness in educational administration similarly emphasizes that institutional preparedness, infrastructure, human-resource capacity, and organizational support are fundamental conditions for effective AI integration.

The very strong direct effect also provides an interesting theoretical interpretation. From the perspective of the Resource-Based View (RBV), AI readiness can be regarded as an organizational capability that creates value when technological resources, human resources, and organizational processes are aligned. The present findings suggest that the value of AI does not primarily come from possessing AI technology itself, but from the institution's readiness to integrate it into actual administrative processes. This interpretation is consistent with recent work showing that organizational AI readiness should be understood as an interdependent combination of technological, organizational, and environmental capabilities rather than as a single technological condition.

The most important finding concerns the proposed mediating role of Digital Competence. The indirect effect of Artificial Intelligence Readiness on Administrative Efficiency through Digital Competence is only approximately  $\beta = 0.003$ , with  $p = 0.902$ . Therefore, Digital Competence does not significantly mediate the relationship between Artificial Intelligence Readiness and Administrative Efficiency. This result differs from studies that emphasize digital competence as an important factor in technology adoption and effective AI use. For example, recent research has found that digital competence can significantly influence AI adoption in educational settings, although other studies have reported mixed results regarding the direct role of digital competence. The inconsistency suggests that the role of digital competence may depend heavily on the outcome being examined.

In the present study, the outcome is administrative efficiency, rather than AI adoption itself. This distinction is important. Digital competence may enable personnel to use digital tools, but administrative efficiency may depend more directly on whether the institution has already established functioning AI-supported systems, procedures, infrastructure, and organizational support. Recent research on education managers also shows that institutional AI readiness and individual readiness can differ substantially, with regulatory uncertainty and competency gaps emerging as important barriers. Therefore, the insignificant mediation should not be interpreted as evidence that Digital Competence is unimportant. Rather, it indicates that Digital Competence alone is not sufficient to translate AI readiness into administrative efficiency in the observed madrasahs.

Overall, this study supports the positive relationship between Artificial Intelligence Readiness and Digital Competence and strongly supports the direct effect of Artificial Intelligence Readiness on Administrative Efficiency, but it does not support the direct effect of Digital Competence on Administrative Efficiency or its mediating role. The main contribution of the study is therefore the identification of a predominantly direct institutional pathway: AI readiness produces administrative benefits more strongly through organizational preparedness and technological integration than through individual digital competence alone. This finding provides a meaningful contribution to Islamic educational management by suggesting that madrasahs seeking to improve administrative efficiency through AI should not focus only on training personnel, but must simultaneously strengthen infrastructure, institutional policies, governance, and the integration of AI into everyday administrative processes.

#### 4. CONCLUSION

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This study concludes that Artificial Intelligence Readiness is an important factor in improving administrative efficiency in madrasahs. The findings demonstrate that Artificial Intelligence Readiness has a positive and significant effect on Digital Competence ( $\beta = 0.292$ ;  $p = 0.009$ ), indicating that institutional preparedness for AI contributes to the development of personnel's digital capabilities. More importantly, Artificial Intelligence Readiness has a very strong and significant direct effect on Administrative Efficiency ( $\beta = 0.951$ ;  $p < 0.001$ ), with the model explaining 91.1% of the variance in Administrative Efficiency.

However, Digital Competence does not have a significant effect on Administrative Efficiency ( $\beta = 0.012$ ;  $p = 0.898$ ). Consequently, Digital Competence also fails to mediate the relationship between Artificial Intelligence Readiness and Administrative Efficiency, as indicated by the very small and insignificant indirect effect ( $\beta = 0.003$ ;  $p = 0.902$ ). These findings indicate that the benefits of AI readiness for administrative efficiency occur predominantly through a direct institutional pathway rather than through digital competence as a mediating mechanism.

The study contributes to Islamic educational management by demonstrating that AI readiness should be understood not merely as the availability of technology but as an institutional capability involving infrastructure, organizational support, policies, and human-resource preparedness. At the same time, the findings indicate that strengthening individual digital competence alone may

not be sufficient to produce administrative efficiency without corresponding institutional systems and effective AI integration.

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