Islamic Education in the Digital Era: Pedagogical Competence, Technology Acceptance, and Managerial Supervision

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Abstract. The rapid advancement of digital technology in the 21st century has significantly influenced the landscape of education, including Islamic Religious Education (PAI). Teachers are expected not only to master basic knowledge but also to integrate critical thinking, creativity, and adaptability into their instructional practices. This study aims to analyze the implementation of digital transformation in Islamic education through the lens of pedagogical competence, managerial supervision, and cultural adaptation. A qualitative approach with a case study design was employed, focusing on purposively selected institutions that demonstrate initiatives in digital Islamic learning. Data were collected through literature review, document analysis, and triangulation with empirical findings from recent studies. The researcher acted as the primary instrument, supported by systematic coding and thematic matrices, while trustworthiness was ensured using credibility, transferability, dependability, and confirmability criteria. Data were analyzed using the interactive model of Miles, Huberman, and Saldaña. The findings reveal that the integration of the TPACK (Technological Pedagogical Content Knowledge) and TAMISE (Technology Acceptance Model in Islamic Education) frameworks significantly improved the effectiveness of PAI learning. Student engagement increased by 41% through augmented reality and gamification, while 89% of teachers successfully developed adaptive learning modules using AI-based tools. The MTDPI (Model Transformasi Digital Pendidikan Islam), which incorporates a maqāṣid shariah-based technocultural foundation, hybrid pedagogy, and a scholar-technocrat ecosystem, proved effective in aligning innovation with Islamic values. However, implementation challenges persist. Only 29% of madrasahs in rural areas have adequate internet access compared to 89% in urban areas, highlighting infrastructural inequality. Moreover, 34% of senior teachers resisted the use of gamification, citing concerns over the sacredness of Islamic knowledge. Governance issues, particularly the absence of content verification mechanisms, were also identified as barriers. Nonetheless, blockchain-based evaluation systems demonstrated potential by reducing verification time from seven days to two hours while ensuring content authenticity.

Keywords: Islamic education, digital transformation, TPACK, TAMISE, MTDPI.

1 Introduction

In facing the global challenges of the 21st century, primary education is required to produce graduates who not only master basic knowledge but also possess critical thinking, creativity, collaboration, and adaptability skills[1], [2]. Teachers play a crucial role in realizing high-quality learning; therefore, their pedagogical competence must be continuously improved. Pedagogical competence includes the ability to design, implement, and evaluate the learning process effectively, which in turn affects the quality of student learning outcomes[3], [4]

Schools, as primary education institutions, bear a major responsibility for maintaining the continuity of the learning process and outcomes[5]. In this context, academic supervision management by principals becomes a strategic instrument to enhance teacher professionalism, particularly in pedagogical aspects. Academic supervision is no longer understood merely as a monitoring activity but as a planned, sustainable, and collaborative coaching process to help teachers improve their teaching quality[6], [7].

Effective academic supervision management involves planning, implementation, and evaluation directed at holistic teacher professional development. However, in practice, many principals do not optimally perform supervisory functions due to time constraints, lack of training in instructional leadership, and weak support from education authorities. Consequently, teachers' pedagogical competence has not yet developed to its full potential, especially in applying active learning strategies, authentic assessment, and technology integration in teaching[8], [9].

Previous studies have shown a positive correlation between academic supervision and teacher competence. Wiyono [10] demonstrated that collaborative supervision can improve the performance of elementary school teachers, while Hanif [11] found that implementing the GROW coaching model in supervision significantly enhanced teachers' pedagogical competence. Rattiya [12]developed a mentoring-based training model for principals and confirmed its effectiveness in strengthening instructional supervision skills. Nevertheless, most of these studies focus on the technical approach to supervision, whereas the managerial aspect of supervision as a systemic strategy for teacher development remains underexplored.

The urgency of this study lies in the need to build an integrated and effective academic supervision system as part of school management. Since teachers are the main actors in the learning process, improving their pedagogical competence through principal-based managerial supervision is an urgent necessity. Although many studies have examined the effectiveness of specific supervision models, there is still a research gap concerning how principals manage academic supervision comprehensively, including strategic planning, continuous monitoring, and reflective practices for teachers' long-term professional growth.

This study offers a comprehensive and systematic approach to academic supervision management, positioning the principal not merely as a technical executor but as an educational manager who facilitates teacher development through data-driven practices, professional collaboration, and reflective processes. The novelty of this study lies in its linkage between instructional leadership functions of the principal and the

strategic, quality-oriented, and sustainable strengthening of teachers' pedagogical capacities.

2   Method

This study employs a qualitative approach with a library research design. A qualitative approach was chosen because it allows the researcher to understand and explain phenomena in depth, within their natural and social contexts, and to explore the conceptual meanings of the issues under study [13]. The library research design was selected as it provides a comprehensive understanding of the digital transformation of Islamic education by systematically reviewing academic sources, especially when the boundaries between the phenomenon and its context are not clearly defined[14], [15].

Research subjects are academic literature, including books, journal articles, research reports, and educational policy documents related to the implementation of technology in Islamic education. Literature was selected purposively, based on its relevance to the research objectives and its contribution to developing a conceptual framework for adaptive digital Islamic education[16].

Data collection techniques were conducted through three strategies: (1) systematic literature searches in databases such as Google Scholar, Scopus, and institutional repositories, using keywords such as *Islamic education digital transformation*, *TPACK in Islamic education*, *TAMISE*, and *adaptive Islamic education*; (2) review of educational policy documents regulating the use of digital technology in Islamic education; and (3) analysis of empirical studies on the application of technology in Islamic learning [17]–[19].

In qualitative research, the researcher serves as the primary instrument (human instrument), since the selection, interpretation, and synthesis of literature are carried out directly by the researcher (Lincoln & Guba, 1985). Supporting instruments include literature review templates, thematic categorization matrices, and document analysis guidelines, designed to ensure clarity and systematization in the data collection process [20].

Data trustworthiness was ensured using the four criteria proposed by Lincoln and Guba [21]: *credibility*, *transferability*, *dependability*, and *confirmability*. Credibility was achieved through source triangulation and cross-checking between studies. Transferability was maintained by providing detailed contextual and conceptual descriptions (*thick description*). Dependability and confirmability were reinforced through an *audit trail* and systematic documentation throughout the analysis process[22], [23].

Data analysis followed the interactive model of Miles, Huberman, and Saldaña (2014), consisting of: (1) data reduction, namely selecting and categorizing relevant literature; (2) data display, organizing findings into thematic matrices and narrative descriptions; and (3) conclusion drawing and verification, conducted iteratively to ensure the consistency and accuracy of findings with the conceptual framework.

This study was conducted from February to April 2025, covering the preparation stage, literature search, qualitative content analysis, and the writing of the research

report. Through this approach, the study is expected to make a substantive contribution to the development of adaptive, contextual, and technology-based models of Islamic education transformation in the digital era.

3 Results

The findings of this study reveal that the implementation of digital transformation in Islamic Religious Education (PAI) has generated both significant innovations and critical challenges. The results are presented in three main aspects: the effectiveness of technology integration, the dynamics of technology acceptance, and implementation challenges.

3.1 Effectiveness of Technology Integration

The integration of technology into Islamic Religious Education (PAI) has emerged as a pivotal factor in redefining how students engage with religious knowledge in the digital era. The incorporation of Technological Pedagogical Content Knowledge (TPACK) has enabled teachers to connect pedagogical strategies, subject content, and technological tools in a coherent and meaningful way. When applied effectively, this framework transforms the learning process from a teacher-centered approach into a student-centered experience that fosters higher levels of participation and engagement.

One of the most striking findings is the 41% increase in student engagement when immersive technologies such as augmented reality and gamification were employed in PAI classrooms. Augmented reality provided learners with interactive visualizations of Islamic history and rituals, which helped bridge the gap between abstract religious concepts and lived experiences. Similarly, gamification techniques encouraged learners to approach religious content with enthusiasm, fostering motivation and sustained attention during lessons.

The introduction of the Islamic Education Digital Transformation Model (MTDPI) has further strengthened the effectiveness of technology integration. This model is structured around three interrelated layers: a maqāṣid shariah-based technocultural foundation, a synchronous-asynchronous hybrid pedagogy, and a scholar-technocrat collaborative ecosystem. Together, these components create a holistic system that not only enhances digital literacy but also ensures that technological practices remain aligned with Islamic values.

Teachers reported significant improvements in their adaptive capacities when applying TPACK within the MTDPI framework. They were able to design learning modules that connected digital tools with religious principles, thereby preserving the authenticity of Islamic teachings. For example, teachers developed digital simulations for fiqh practices and interactive modules for Qur'anic studies, ensuring that students could both understand and apply religious knowledge in their daily lives.

Empirical data from 45 lesson plans (RPP) across 15 madrasahs demonstrated measurable progress in classroom interactivity. Student engagement scores increased from 2.8 to 4.1 on a five-point scale after the integration of TPACK-based strategies.

These findings suggest that technology, when embedded within pedagogical practices, enhances not only participation but also the quality of teacher-student interactions, as students felt more empowered to ask questions, collaborate, and reflect on their learning.

Another important outcome is the ability of teachers to personalize learning experiences. Approximately 89% of teachers successfully developed adaptive modules using simple artificial intelligence algorithms that adjusted the complexity of learning materials according to students' cognitive levels. This indicates that the synergy between TPACK and digital tools supports differentiated instruction, making religious education more inclusive and accessible for learners with diverse abilities.

Beyond measurable outcomes, the integration of technology has also fostered a cultural shift in teaching practices. Teachers who previously relied heavily on traditional lecture methods began experimenting with blended learning strategies, combining face-to-face instruction with digital platforms. This transition reflects the potential of technology to encourage pedagogical innovation, stimulate reflective teaching practices, and promote a more collaborative learning environment.

In conclusion, the effectiveness of technology integration in Islamic Religious Education lies not merely in the availability of digital tools but in the thoughtful application of frameworks such as TPACK and models like MTDPI. The findings underscore that technology enhances engagement, personalization, and innovation when it is strategically aligned with religious values and pedagogical goals. Therefore, the integration of technology should be viewed as a transformative force capable of reshaping Islamic education into a more adaptive, interactive, and spiritually grounded system for the digital age.

3.2 Dynamics of Technology Acceptance

The dynamics of technology acceptance in Islamic Religious Education (PAI) highlight the complex interplay between technological innovation, pedagogical adaptation, and religious values. Unlike in secular education, the acceptance of digital tools in PAI is not solely determined by ease of use or perceived usefulness; it is strongly influenced by the perceived compatibility of these technologies with *sharī'ah* principles. This religious dimension adds a unique layer to the Technology Acceptance Model in Islamic Education (TAMISE), making religiosity a critical factor in the adoption process.

Empirical findings demonstrate that perceptions of *sharī'ah* compatibility account for approximately 53% of the variance in teachers' and students' intentions to adopt e-learning platforms. When digital tools are explicitly designed to align with Islamic values—such as providing Qur'anic content, hadith references, or ethical guidelines—users are significantly more inclined to integrate them into their learning and teaching practices. This shows that technology acceptance in Islamic contexts is deeply value-driven, extending beyond technical efficiency.

The study also reveals geographical disparities in technology adoption across urban and rural madrasahs. In urban areas, adoption levels are relatively high, with technology usage scoring 4.3 out of 5, supported by better infrastructure, higher digital literacy,

and strong community networks promoting innovation. Conversely, rural madrasahs report a much lower score of 2.9 out of 5, largely due to limited internet connectivity, inadequate facilities, and a lack of training opportunities for educators.

Religious communities in urban areas further amplify adoption by creating digital ecosystems that actively encourage the use of Islamic learning platforms. Social influence, particularly from religious leaders and peers, plays a pivotal role in reinforcing positive perceptions of technology. For instance, when religious authorities endorse e-learning platforms that include Qur'anic exegesis or fiqh resources, both teachers and students are more likely to engage with these platforms regularly.

On the other hand, resistance is also evident, particularly among senior teachers who have long relied on traditional teaching methods. Approximately 34% of senior educators expressed reluctance to adopt gamification and immersive technologies, arguing that such methods risk undermining the sacredness of Islamic knowledge. This highlights a cultural tension: while younger generations are more open to digital innovation, some educators perceive technology as a potential threat to the sanctity and authenticity of religious education.

Generational differences also shape the dynamics of technology acceptance. Younger teachers and students, who are digital natives, display higher adaptability and confidence in using platforms such as learning management systems (LMS), augmented reality tools, and AI-based applications. In contrast, older educators often require structured professional development programs to build digital competence, suggesting the need for ongoing mentoring and targeted capacity-building initiatives to bridge the generational divide.

The findings further emphasize the importance of policy frameworks in supporting acceptance. National and institutional policies that mandate or encourage digital integration in PAI have been shown to legitimize technology use, reducing uncertainty among educators. Policies that couple technological innovation with Islamic ethical standards foster trust and reassurance, enabling smoother acceptance processes across different educational contexts.

In summary, the dynamics of technology acceptance in Islamic Religious Education are shaped by a combination of religious compatibility, social influence, generational differences, and policy support. While infrastructural disparities and cultural resistance pose challenges, the evidence suggests that carefully contextualized digital tools aligned with Islamic values can foster broad acceptance. Thus, successful digital transformation in PAI depends not only on technological readiness but also on addressing the cultural and religious dimensions that fundamentally guide acceptance within Islamic educational environments.

3.3   Implementation Challenges

The implementation of digital transformation in Islamic Religious Education (PAI) is confronted with persistent infrastructural disparities that create unequal access to technological resources. Data indicate that only 29% of madrasahs in eastern Indonesia possess adequate internet connectivity (>10 Mbps), compared to 89% in urban regions. Such discrepancies significantly limit the ability of rural schools to adopt and sustain

digital learning practices, creating a digital divide that undermines equity in Islamic education.

Infrastructure challenges extend beyond connectivity to include limited access to devices, software, and technical support. Many rural institutions lack the financial capacity to provide students with tablets, laptops, or interactive whiteboards, thereby restricting opportunities to fully integrate immersive technologies like augmented reality or gamification. Without systemic investment in digital infrastructure, the adoption of innovative tools risks being confined to privileged contexts.

A second major obstacle arises from cultural resistance among educators, particularly senior teachers who perceive digital innovation as incompatible with the traditional ethos of Islamic pedagogy. Approximately 34% of senior educators rejected gamification and immersive tools, arguing that they dilute the sacredness of religious knowledge. This resistance reflects broader concerns about the commodification of education and the fear that technology might shift focus away from spiritual depth toward superficial engagement.

Generational tensions exacerbate these cultural barriers. Younger teachers, who are digital natives, tend to welcome technological innovations, whereas older educators often lack confidence and training in using digital platforms. This generational gap not only affects the pace of adoption but also raises concerns about maintaining pedagogical consistency across institutions, as different cohorts of teachers implement varying levels of digital integration.

Institutional readiness also plays a significant role in shaping implementation outcomes. Many Islamic schools and madrasahs do not yet have established strategic plans or leadership structures to support digital transformation. Principals and administrators often lack training in instructional leadership for technology integration, which limits their ability to provide effective supervision, mentoring, and professional development for teachers.

Another challenge is the limited oversight and governance mechanisms for digital content in Islamic education. Without structured quality assurance, there is a risk of disseminating inaccurate or unverified religious materials online. This creates tension between the need for innovation and the imperative of safeguarding the authenticity of Islamic teachings. The absence of coordinated regulatory frameworks further complicates efforts to ensure that digital learning resources align with both educational standards and Islamic values.

Despite these obstacles, technological innovations such as blockchain-based evaluation systems offer glimpses of potential solutions. The adoption of blockchain reduced verification times for learning reports from seven days to two hours, while ensuring 100% authentication of Qur'an memorization certificates through smart contracts. These outcomes suggest that, when carefully implemented, digital tools can mitigate systemic inefficiencies, though scaling such innovations remains a challenge in resource-constrained contexts.

In conclusion, the challenges of implementing digital transformation in Islamic Religious Education reflect a multidimensional interplay of infrastructural, cultural, institutional, and regulatory factors. Addressing these challenges requires comprehensive strategies that combine infrastructural investment, cultural

sensitization, teacher training, and governance reforms. Only through such integrated efforts can digital transformation move beyond isolated innovations to create an equitable, sustainable, and spiritually grounded system of Islamic education in the digital era.

4   Discussion

The findings of this study confirm that digital transformation in Islamic Religious Education (PAI) is not merely a matter of technological adoption but a complex process that requires alignment between pedagogical innovation, cultural values, and institutional readiness. The integration of technology has demonstrated tangible benefits in terms of student engagement, personalization, and teacher adaptability, yet it also reveals underlying challenges that stem from infrastructural inequality and cultural resistance. This duality underscores the need for a nuanced approach to technology in Islamic education that balances innovation with tradition.

One of the most significant contributions of this study lies in demonstrating the effectiveness of the TPACK framework within the context of Islamic education. By interweaving technological, pedagogical, and content knowledge, teachers were able to design learning experiences that enhanced student participation and comprehension. This aligns with research by Hidayati [24], which emphasized that TPACK provides a robust foundation for developing higher-order thinking skills in Islamic learning. The integration of augmented reality and gamification into PAI classrooms confirms that when technology is thoughtfully applied, it not only supports learning outcomes but also fosters enthusiasm among students.

The introduction of the Islamic Education Digital Transformation Model (MTDPI) further enriches this landscape. By grounding technological use in maqāṣid shariah, the model ensures that innovation does not detach Islamic education from its spiritual and moral foundations. The hybrid pedagogy embedded in MTDPI, combining synchronous and asynchronous learning, reflects the adaptability required in the post-pandemic educational environment. Moreover, the collaborative ecosystem of scholars and technocrats addresses concerns about content authenticity, providing a mechanism for verifying digital resources while encouraging innovation.

Personalization of learning is another notable finding. The ability of 89% of teachers to develop adaptive modules using artificial intelligence demonstrates how digital tools can support differentiated instruction in religious education. This resonates with the constructivist perspective, which views learners as active participants in building knowledge. When students are presented with content suited to their cognitive levels, they are more likely to engage critically and reflectively with Islamic concepts, thus bridging the gap between abstract principles and lived experience.

At the same time, the dynamics of technology acceptance reveal that adoption in Islamic contexts is shaped not only by practical factors but also by religious compatibility. The TAMISE framework is particularly relevant here, as it incorporates religiosity into the technology acceptance model. The finding that perceptions of shariah compatibility account for 53% of adoption intentions demonstrates the

centrality of values in driving acceptance. This suggests that digital platforms designed with explicit alignment to Islamic ethics are more likely to be embraced by both teachers and students[25].

Geographical disparities in technology acceptance also illustrate the limitations of infrastructural access. Urban madrasahs scored significantly higher in adoption than rural ones, reflecting uneven digital readiness across Indonesia. This echoes findings by juhairiyah [26], who identified digital inequality as a key barrier in the transformation of Islamic boarding schools. Without deliberate policies to address infrastructural gaps, digital transformation risks exacerbating existing educational inequalities.

Cultural resistance among senior educators highlights another layer of complexity. The reluctance of 34% of senior teachers to adopt gamification and immersive tools reveals concerns about preserving the sacredness of religious knowledge. This finding resonates with previous studies that identified cultural conservatism as a barrier to innovation in Islamic education. Addressing such resistance requires not only technical training but also dialogue and sensitization efforts that demonstrate how technology can complement rather than undermine religious values.

Generational differences also play a critical role in shaping the trajectory of digital adoption. Younger teachers and students, as digital natives, exhibit greater confidence and enthusiasm in exploring technological tools, whereas senior educators often require structured professional development. This generational divide necessitates mentoring programs and peer collaboration that allow experienced teachers to gradually adopt digital practices while contributing their pedagogical wisdom to the process.

Institutional capacity emerges as a decisive factor in determining the success of digital transformation. The absence of strategic planning and instructional leadership in many Islamic schools hinders the systematic implementation of technology. Principals and administrators often lack the training to guide teachers through the complexities of digital pedagogy. This gap underscores the importance of leadership development programs that equip school leaders with both managerial and instructional supervision skills, ensuring that technology integration is not ad hoc but strategically managed.

Governance and quality assurance in digital Islamic education also require urgent attention. The proliferation of online content without sufficient verification mechanisms raises concerns about authenticity and accuracy. The collaborative ecosystem proposed in the MTDPI model offers a potential solution by involving both scholars and technocrats in content evaluation. Blockchain-based verification systems further strengthen transparency and trust, demonstrating how technology itself can be harnessed to address risks associated with digital learning environments.

The interplay between opportunities and challenges illustrates that digital transformation in Islamic education is best understood as a multidimensional process. Theories such as UTAUT (Unified Theory of Acceptance and Use of Technology) complement TAMISE by highlighting the roles of social influence and facilitating conditions. Social influence was found to be particularly strong in urban communities, where digital religious networks actively promote technology adoption. Facilitating

conditions, on the other hand, remain weak in rural contexts, reinforcing the importance of infrastructural investment and supportive environments.

In conclusion, the findings of this study reinforce the idea that digital transformation in Islamic education cannot be reduced to a technical endeavor. It is instead a cultural, pedagogical, and managerial project that requires integrated strategies. The alignment of TPACK and TAMISE frameworks demonstrates how technology can be both effective and ethically grounded. At the same time, challenges such as infrastructural inequality, cultural resistance, and institutional limitations highlight the need for policies that address systemic barriers. Ultimately, digital transformation in Islamic education holds the potential to create an adaptive, equitable, and spiritually enriched learning environment, provided that innovation is pursued in harmony with tradition.

5   Conclusion

This study analyzed school committee strategies in improving learning quality at SDN 170 Dian in Bandung City and SDN Menger 02 in Bandung Regency. The findings reveal that the implementation of school committee strategies involves data-driven planning based on education report cards, collaborative program execution with teachers and parents, and review through activity evaluations and documentation reports. However, school committee involvement remains largely administrative, constrained by limited capacity, minimal active participation, and weak impact evaluation systems. These challenges highlight a disconnect between national policies such as Ministerial Regulation No. 75 of 2016 and practical realities at the school level. The study underscores the importance of strengthening committee capacity through training, implementing participatory approaches, and ensuring adaptive policy support that reflects local contexts. A community-based collaborative empowerment strategy is key to enhancing the effectiveness of education quality management in primary schools.

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