

Digital Madrasah Management Model Based on the Exambro Application in Islamic Education Learning: A Case Study at MAN 2 Rembang

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ABSTRACT

Purpose – This study aims to explore the management, policies, program implementation, challenges, and alternative solutions related to the implementation of the Digital Madrasah program at MAN 2 Rembang.

Design/methods/approach – Employing a qualitative field-based case study approach, data were collected through observation, interviews, and document analysis. Primary data were obtained directly from key informants, including the Madrasah Principal, Vice Principals for Curriculum and Facilities, Islamic Education (PAI) teachers, and students. Secondary data were drawn from administrative and instructional documents. Data analysis involved reduction, display, and conclusion drawing.

Findings – (1) The Digital Madrasah program at MAN 2 Rembang is managed in accordance with the guidelines of the Ministry of Religious Affairs and the Ministry of Education. (2) Management is guided by official policies and implementation manuals. (3) Program implementation follows UNESCO's ICT integration stages: emerging, applying, integrating, and transforming. (4) Key challenges include infrastructure limitations, varying digital competencies, data security concerns, exam dishonesty, limited funding, and weak oversight. (5) Proposed solutions include enhancing technological infrastructure and competencies, fostering external collaboration, and implementing continuous evaluation.

Research implications/limitations – This study supports the effective implementation of the Digital Madrasah program using the Exambro application in accordance with Ministry of Religious Affairs guidelines. However, its scope is limited to a single institution, with a short data collection period and no assessment of learning outcomes. Future studies should adopt quantitative and comparative approaches for broader insights.

Originality/value – This study contributes to the advancement of the Digital Madrasah initiative by integrating the Exambro application into Islamic Education learning. The findings offer practical guidance for educators and curriculum developers in designing more effective instructional strategies and provide a replicable management framework adaptable to other madrasahs.

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Introduction

Digital transformation in education has emerged as a global imperative in the era of the Fourth Industrial Revolution. In Indonesia, this transformation has been addressed through various strategic initiatives, one of which is the School Digitalization Program launched by the Ministry of Education and Culture. In the context of religious education, the Ministry of Religious Affairs has introduced the Digital Madrasah program, which aims to integrate information and communication technology (ICT) into both instructional practices and madrasah governance (Saimroh et al., 2018; Ministry of Religious Affairs, 2019).

The implementation of the Digital Madrasah program is supported by a number of regulatory frameworks, including the Regulation of the Minister of National Education (Permendiknas) No. 19 of 2007 concerning Educational Management Standards, and Presidential Regulation No. 39 of 2019 on One Data Indonesia, which emphasizes the importance of an integrated and digitalized public data system (Adinegoro et al., 2025; Maulidya & Rozikin, 2022). Furthermore, a series of circulars and technical guidelines issued by the Directorate General of Islamic Education have elaborated on the policy direction, including the adoption of the Digital Madrasah Report (RDM) and the use of application-based assessment systems such as Exambro (KSKK Madrasah, 2018).

Survey findings conducted via online platforms indicate that numerous madrasahs across various Indonesian provinces have implemented the Digital Madrasah program, including those in Central Java Province, particularly in Rembang Regency. Rembang is the easternmost regency in the province (Aziz et al., 2024). Although the region is characterized by uneven technological development in the context of the Fourth Industrial Revolution or the digital era (Ratnawati & Werdiningsih, 2020), certain madrasahs—such as MAN 2 Rembang—have adopted the digital madrasah system and have even been designated as “Smart Madrasahs” (Rahmat, 2020).

Despite the presence of a clear policy framework, several studies have indicated that the implementation of the Digital Madrasah program continues to face significant challenges at the institutional level. Gunawan (2023) observes that the use of the Exambro application in public schools often encounters technical barriers, such as device incompatibility and insufficient infrastructure. Aziz et al. (2024) emphasize that in the context of Islamic Religious Education (PAI), the primary obstacle lies in teachers’ limited capacity to deliver religious content in an interactive and digital format. In addition, Gusriani et al. (2023) argue that human resource management within digital madrasahs has not fully addressed the need for comprehensive training and professional supervision.

Another study conducted by Rofiq et al. (2023) explores the technical aspects of Exambro-based examinations but does not assess their effectiveness in the context of PAI learning. Fadlyani et al. (2023) further note that digitalizing Islamic education extends beyond the provision of technological infrastructure; it also demands a transformation in pedagogical culture and strong managerial commitment. However, most existing studies tend to focus on digitalization in general, without specifically examining how the Digital Madrasah program is managed within the pedagogical framework of PAI—particularly in peripheral madrasahs such as MAN 2 Rembang, which operate under the distinctive challenges of non-urban areas.

Consequently, there remains a research gap in exploring how the management of the Digital Madrasah program is implemented through a contextual case study approach, with a focus on specific applications like Exambro and within the pedagogically distinctive domain of Islamic Religious Education. Furthermore, few studies have applied UNESCO’s ICT

integration model (emerging, applying, integrating, transforming) as a framework for evaluating digital madrasah programs.

To address this gap, the present study aims to conduct an in-depth analysis of the management of the Digital Madrasah program, specifically regarding the use of the Exambro application in PAI learning at MAN 2 Rembang. The study focuses on planning, implementation, evaluation, field challenges, and alternative solutions based on practical experiences. The findings are expected to enrich academic discourse on Islamic education digitalization and offer practical contributions to the development of digital madrasah management models in emerging regions.

Methods

1. Design and Research Approach

This study employed a qualitative approach with a field case study design (Rukin, 2021). The aim was to gain an in-depth understanding of the management of the Digital Madrasah program based on the use of the Exambro application in the Islamic Religious Education (PAI) cluster at MAN 2 Rembang.

2. Research Location and Period

The research was conducted at MAN 2 Rembang, Central Java, which is recognized as a Smart Madrasah. The site was selected due to its relevance to the implementation of the Digital Madrasah program and its active use of the Exambro application. The study took place from December 2023 to February 2024.

3. Research Subjects

The research subjects or informants included: (1) The Principal of MAN 2 Rembang, (2) The Vice Principal for Curriculum Affairs, (3) The Vice Principal for Facilities and Infrastructure, (4) Islamic Religious Education (PAI) teachers for Grades X, XI, and XII and (5) Students from Grades X, XI, and XII at MAN 2 Rembang

4. Data Collection Techniques and Instruments

Data were collected using the following techniques: (1) Observation: Conducted through direct, non-participant observation of phenomena in the field (Sugiyono, 2016), such as observing the management of the Digital Madrasah program and the use of the Exambro application at MAN 2 Rembang. (2) Interviews: Semi-structured interviews were used to gather detailed insights into the research problems (Arifin, 2019). (3) Documentation: Supporting documents such as organizational structures, policies, annual work plans (RKT), instructional tools, Digital Madrasah program guidelines, and activity photos were reviewed.

5. Data Validity

Data validity was ensured through source and technique triangulation, by comparing the findings from interviews, observations, and document analysis to enhance the credibility of the results (Nugrahani, 2014).

6. Data Analysis

Data analysis followed the Miles and Huberman model, consisting of: (1) Data reduction: Filtering essential information from observations, interviews, and documents

(Umar Sidiq, 2019). (2) Data display: Organizing information into thematic narratives. (3) Conclusion drawing: Interpreting the core meanings and findings related to the management of the Digital Madrasah program based on the Exambro application (Sugiyono, 2016) at MAN 2 Rembang.

Result

1. Management of the Digital Madrasah Program through the Exambro Application in PAI Learning at MAN 2 Rembang

The management of the Digital Madrasah program at MAN 2 Rembang refers to the Minister of National Education Regulation (Permendiknas) No. 19 of 2007, which includes components of planning, implementation, supervision and evaluation, leadership, and management information systems (Arikunto, 2017). These five components have been integrated into the digitalization program of the madrasah, including the use of the Exambro application as a learning tool for the Islamic Religious Education (PAI) cluster.

Table 1

Management of the Digital Madrasah Program at MAN 2 Rembang

No.	Management Aspect	Key Findings
1	Planning	Revision of the vision, mission, objectives, and work plans with a digital orientation
2	Implementation	Use of digital curriculum, ICT training, and provision of digital learning media
3	Evaluation and Supervision	Conducted regularly, but constrained by limited funding and infrastructure
4	Leadership	The school principal supports digital transformation grounded in Islamic values and contemporary progress
5	Information System	Utilization of Exambro, LMS, and the school website as part of the digital information system

1.1. Planning of the Digital Madrasah Program at MAN 2 Rembang

The planning of the Digital Madrasah program was carried out through updates to the vision, mission, goals, and work plans, all of which are oriented toward digital transformation (MAN 2 Rembang, 2023).

(1) Vision and Mission

MAN 2 Rembang has formulated a vision to become a *Smart Madrasah*, emphasizing the excellence of students in science, technology, and Islamic values. The mission is directed toward supporting digital transformation at all levels of the educational unit.

(2) Objectives

The objectives of the Digital Madrasah program include the introduction, application, integration, and transformation of technology. One specific objective is to improve students' proficiency in digital technology and vocational skills.

(3) Work Plan

The work plan is developed based on digitalization needs and includes:

- The implementation of the *Merdeka Curriculum* and the 2013 Curriculum (K13), integrated with digital-based learning, including in PAI subjects.
- The development of ICT competencies for teachers and education personnel.
- The provision of digital infrastructure such as digital classrooms, internet networks, the Exambro application, the madrasah website, and a Learning Management System (LMS). However, development efforts are still limited due to budget constraints, as funding depends on the operational assistance (BOS) from the Ministry of Religious Affairs.

The above information is largely based on interviews with the school principal, who emphasized the importance of keeping pace with technological developments as part of the madrasah's digital transformation vision.

1.2. Implementation of the Digital Madrasah Work Program at MAN 2 Rembang

The implementation of the digital madrasah program at MAN 2 Rembang is carried out through a series of activities encompassing key aspects of educational management. These include the readiness of instructional administration, integration of digital media into the teaching and learning process, and the involvement of all madrasah stakeholders in supporting the program's success (Anderson & Dron, 2011). These components are interrelated and form an integral part of the broader effort to achieve comprehensive and sustainable digital transformation within the institution.

(1) Administrative Preparation

Teachers prepare instructional administration documents such as lesson plans (Learning Objectives Flow/ATP) and utilize digital media. However, the implementation is not yet consistent across all subjects due to limitations in infrastructure and school policies regarding student device usage.

(2) Program Implementation

Program activities are executed based on the Madrasah Work Plan (RKM), although some discrepancies occur due to limited facilities and varying readiness among human resources. Teacher board meetings and committee sessions serve as forums for program accountability.

(3) Role of the School Principal

The principal plays an active role in drafting and revising the RKM annually to support digital transformation both academically and non-academically.

Based on the data, the average scores for the pre-test and post-test are as follows:

Table 2

Implementation of Digital Madrasah Management at MAN 2 Rembang

No.	Implementation Aspect	Key Findings
1	Administration	Digital-based lesson plans are prepared, but not yet evenly applied
2	Learning Media	Use of digital applications is limited to certain conditions

No.	Implementation Aspect	Key Findings
3	Coordination and Accountability	Conducted through teacher and committee meetings
4	Leadership Support	The principal leads the annual revision of the Madrasah Work Plan

1.3. Evaluation of the Digital Madrasah Program at MAN 2 Rembang

The evaluation of the digital madrasah program at MAN 2 Rembang is conducted regularly, at the end of each semester and academic year. This evaluation aims to ensure that the program implementation aligns with the planned objectives and has a positive impact on the quality of digital-based learning.

The evaluation focuses on several key aspects, including the effectiveness of the Exambro application in the learning process, the performance of both educators and students in integrating digital technology, and the readiness and availability of supporting infrastructure (Nurhayati et al., 2023). Through this process, the school is able to assess how effectively the learning application is being utilized, how well teachers and students are adapting to the digital system, and how adequate the available infrastructure is in sustaining the program.

All evaluation results are collaboratively analyzed by the principal, the management team, and the school committee. These analyses serve as the basis for designing improvement plans for the subsequent period. The follow-up actions are not only aimed at addressing technical issues but also include enhancing teacher competencies through further training, upgrading digital facilities and infrastructure, and refining the curriculum to be more responsive to technological developments.

Through systematic and participatory evaluation processes, MAN 2 Rembang demonstrates its commitment to maintaining the quality of digital madrasah management in a sustainable manner. A summary of the evaluation results is presented in Table 3 below:

Table 3

Evaluation Results of the Digital Madrasah Program at MAN 2 Rembang

No.	Evaluation Aspect	Key Findings
1	Evaluation Timing	Conducted regularly at the end of each semester and academic year
2	Evaluated Components	Includes effectiveness of learning applications, quality of human resources, and infrastructure
3	Follow-Up Actions	Development of improvement plans, teacher training, and enhancement of supporting facilities
4	Evaluation Objective	To assess efficiency, effectiveness, and accountability in digital program management

2. Policy Implementation of the Digital Madrasah Program Using the Exambro Application in Islamic Education Learning at MAN 2 Rembang

The research conducted at MAN 2 Rembang reveals that the implementation of the digital madrasah program adheres to national policies, such as Circular Letter No. B-4181/DJ.I/Dt.I.I/PP.00/2021 regarding the use of the Exambro application for computer-based assessment, and Circular Letter No. B-1726/DJ.I/Dt.I.I/PP.00/06/2021 on the use of the Madrasah Digital Report (RDM) (KSSKK Madrasah, 2021). The Exambro application facilitates the administration of daily assessments, midterm tests, final semester exams, and madrasah examinations in a digital format, while the RDM system is used to manage and report student learning outcomes in a more transparent and efficient manner (Setiawan, 2021).

The implementation of these policies reflects MAN 2 Rembang's serious commitment to supporting the national digitalization of education. According to the Vice Principal for Curriculum Affairs, the school has developed a Digital Assessment System (Sistem Penilaian Digital/SPD) that previously utilized tools such as Google Forms, Google Classroom, and Microsoft Teams, but now focuses primarily on Exambro as the main platform.

Analyzed through UNESCO's digital transformation framework, the current state of MAN 2 Rembang can be categorized at the "integrating" stage, where digital technologies have been adopted into learning and management processes, but have not yet led to a full transformation in pedagogical practices. The "transforming" stage—characterized by a complete redefinition of learning models through digital innovation—has not yet been fully achieved due to limited pedagogical innovation, unequal access to infrastructure, and the need for improved teacher competence in utilizing technology optimally.

To enhance future strategies, the following SWOT analysis outlines the current condition of digital madrasah program implementation at MAN 2 Rembang:

Table 4

SWOT Analysis of Digital Madrasah Program Implementation at MAN 2 Rembang

No.	SWOT Aspect	Description
1	Strengths	<ul style="list-style-type: none"> • Clear and strong national policy support from the Ministry of Religious Affairs • Strong commitment from school leadership and curriculum team in digitalization efforts
2	Weaknesses	<ul style="list-style-type: none"> • Uneven technological competence among teachers • Limited availability of digital infrastructure • Lack of innovation in digital teaching approaches
3	Opportunities	<ul style="list-style-type: none"> • Technical support and training from the Ministry of Religious Affairs • Potential for collaboration with educational technology platforms • Increasing digital literacy among students
4	Threats	<ul style="list-style-type: none"> • Resistance to change from some teachers or student • Technical disruptions during online examinations • Risks related to data security and digital privacy

Based on the SWOT analysis presented in the Table 4, the development strategy for the digital madrasah program at MAN 2 Rembang should focus on enhancing human resource capacity through regular training, upgrading and equalizing infrastructure, and developing more creative and transformative digital learning models. These efforts are expected to support MAN 2 Rembang in achieving a complete and sustainable digital transformation, in line with the national vision of digital madrasah development.

3. Implementation of the Digital Madrasah Program in the Use of the Exambro Application in Islamic Religious Education Learning at MAN 2 Rembang

The implementation of the Digital Madrasah Program at MAN 2 Rembang is analyzed through three core elements of management: planning, implementation, and evaluation (Duryat, 2023).. These are examined in relation to UNESCO's ICT development stages: emerging, applying, integrating, and transforming.

3.1. Emerging

At this stage, MAN 2 Rembang demonstrates characteristics of the *emerging* phase by initiating the procurement of ICT equipment such as computers, laptops, and internet access as foundational elements for the digitalization program. However, observations revealed that internet access is not evenly distributed across all classrooms. One teacher noted that Wi-Fi is only available in certain areas and does not yet cover the entire learning environment (Huda, 2023).

The madrasah has also introduced the Exambro application as part of its digitalization initiative, designing technical training programs for educators to enable them to operate this computer-based examination system.

3.2. Applying

The implementation of the program has entered the *applying* phase. The madrasah has conducted a four-day technical guidance session (Bimbingan Teknis/Bimtek) on the use of Exambro, attended by all educators on a rotational basis. In classroom learning, some teachers have begun using digital media such as PowerPoint presentations and instructional videos. However, the methods and extent of technology use vary among teachers. Some educators expressed limitations in using digital media due to students' lack of skills in utilizing the tools appropriately.

3.3. Integrating

At this stage, MAN 2 Rembang exhibits efforts toward *transforming* by implementing a Digital Assessment System (Sistem Penilaian Digital/SPD) for daily, midterm, and final assessments. The platforms used include Google Forms, Google Classroom, and Exambro (Yelland, 2011).

Nonetheless, interview results indicate that digital media integration is not yet consistent across all subjects. Some teachers still prefer conventional methods, believing that digital media may distract students from the learning process. On the other hand, some students expressed a desire for more innovative and interactive learning through digital platforms.

3.4. Transforming

In the *transforming* phase, MAN 2 Rembang shows signs of broader integration of digital media into learning, although this is not yet uniform across all subjects and

educators. This phase is marked by the use of digital media not only as supplementary tools but also as part of pedagogical strategies aimed at enhancing interactivity, creativity, and student engagement.

Some teachers have started using tools such as LCD projectors, PowerPoint, and digital platforms to facilitate discussions, connect subject matter with current issues, and promote contextual learning. However, such utilization remains partial. Observations and interviews revealed varying levels of technology adoption across subjects. For instance, the SKI (Islamic Cultural History) teacher has attempted to relate lessons to social issues using digital media to a limited extent, while other subjects such as Qur'an Hadith continue to rely on lecture-based and memorization methods, with minimal or no use of digital tools.

Some teachers expressed concerns that digital media use can distract students. They observed that when given access to digital devices, some students became preoccupied with other applications such as social media, which hindered learning objectives. As a result, certain teachers preferred conventional teaching methods, which they found more controllable and better suited to the students' learning characteristics.

This condition illustrates that although MAN 2 Rembang has established supportive policies for digital transformation, practical implementation remains limited to teachers who are prepared and willing to adapt. Meanwhile, some students have started expressing interest in more diverse and digital learning experiences, as they feel traditional methods are too monotonous. This presents both a challenge and an opportunity for the madrasah to promote broader digital transformation by supporting teacher readiness and mentoring, while simultaneously enhancing students' digital literacy.

4. Management Challenges in the Implementation of the Digital Madrasah Program through the Use of the Exambro Application in Islamic Religious Education Learning at MAN 2 Rembang

The implementation of the Digital Madrasah Program through the Exambro application at MAN 2 Rembang faces several challenges at each stage of educational management. These challenges must be identified comprehensively to ensure the sustainability and effectiveness of the program.

4.1. Challenges in the Planning Stage

(1) Limited Technological Infrastructure

The digital infrastructure at MAN 2 Rembang does not yet fully support the optimal implementation of the program. Learning devices such as computers, digital televisions, and internet networks remain limited. According to the Vice Principal for Facilities and Infrastructure, digital devices are currently available only in the laboratory, while classrooms rely on LCD projectors. Moreover, the school's internet network is not yet stable enough to serve all students adequately.

(2) Budget Constraints

Funding for infrastructure procurement and digital media development mostly comes from regional operational funds (BOSDA), which are limited. This

constraint makes it difficult to provide adequate devices and training for both teachers and students.

4.2. Challenges in the Implementation Stage

(1) Teacher Competence and Adaptation

Some teachers in the Islamic Religious Education (PAI) cluster have not fully mastered the use of digital media. Although many teachers have made attempts to adopt it, some are reluctant to transition from conventional methods due to personal comfort. Factors such as age, habitual teaching practices, and individual motivation influence the extent of teacher participation in this program.

(2) Student Readiness

Some students face difficulties in accessing the Exambro application due to the lack of personal devices and unstable internet connections. Additionally, several students perceive digital media as a source of distraction. The restrictive policies on mobile phone use in the boarding school environment also limit their access to learning tools.

(3) Exam Security and Integrity

The use of free applications like Exambro raises concerns regarding potential cheating. The application does not fully restrict students' access to other sources on their devices, posing a risk to the integrity of online assessments.

4.3. Challenges in the Evaluation Stage

(1) Evaluation of Program Effectiveness

There is currently no structured system in place to evaluate the impact of using the Exambro application on student learning outcomes. Assessments remain subjective and rely heavily on teacher and student feedback.

(2) Continuous Monitoring

A lack of tools and resources for routine monitoring also presents a challenge. Teachers have not yet received training in data-based evaluation, which limits the ability to conduct long-term monitoring of the application's effectiveness.

Table 5

Challenges in the Management of the Digital Madrasah Program at MAN 2 Rembang

No.	Management Aspect	Challenges	Description
1.	Planning	Limited infrastructure and budget	Unstable internet network, limited BOSDA funding, devices not equally distributed across classrooms
2.	Implementation	Teacher competence, student readiness, and exam security	Some teachers are reluctant to switch to digital methods, students face device access issues, Exambro is not fully secure

No.	Management Aspect	Challenges	Description
3.	Evaluation	Lack of structured evaluation system, limited monitoring	Evaluation is not systematically documented, teachers lack skills in monitoring Exambro usage

4.4. Alternatives to Improve the Management of the Digital Madrasah Program through the Use of the Exambro Application in Islamic Religious Education Learning at MAN 2 Rembang

Based on the findings related to the positive impacts and challenges of using the Exambro application, several transformative solutions can be implemented to enhance the management of the Digital Madrasah Program for Islamic Religious Education learning at MAN 2 Rembang. These solutions are proposed as part of a model we refer to as the SMART-PAI Model, which integrates technical, human resource, and continuous evaluation aspects.

(1) Upgrading Technological Infrastructure

Improving technological infrastructure is a top priority, encompassing the enhancement of fast and stable internet access as well as the provision of adequate hardware. A robust infrastructure ensures smooth access to digital learning resources and the continuity of dynamic instruction. Furthermore, stabilizing the electrical supply and increasing the availability of digital tools in each classroom are crucial to support interactive learning. Optimizing the Exambro application is also part of creating a conducive digital learning environment.

(2) Training and Competency Development for Teachers and Students

Ongoing education and training for both teachers and students in the use of the Exambro application must be intensified. This includes training on application operations, maximizing the use of features, and managing data security. It is recommended that MAN 2 Rembang organize regular technical guidance (Bimtek) as part of its support for the implementation of the Digital Madrasah Program. On the student side, development efforts should aim to enhance motivation and digital skills, enabling them to become more confident and productive in utilizing educational technology.

(2) Collaboration with External Stakeholders

Establishing partnerships with the developers of Exambro and other educational institutions is a strategic step to gain technical support, training opportunities, and additional resources. Raising awareness and fostering engagement with external parties is essential to support the development of the Digital Madrasah Program. Through such collaborations, MAN 2 Rembang can strengthen its commitment to becoming a Smart Madrasah that is adaptive and innovative in technology-based learning.

(3) Implementation of a Continuous Monitoring and Evaluation System

Implementing a structured and regular monitoring and evaluation system is essential to measure the effectiveness of the Exambro application. This system should involve collecting data on student performance, teacher feedback on learning outcomes, and user satisfaction levels. Such data will enable the madrasah to conduct in-depth analysis, identify obstacles, and plan continuous improvements, thereby significantly enhancing the quality of digital learning.

Discussion

1. Synchronization of Digital Management with the National Education Structure

Findings indicate that the management of the Digital Madrasah Program at MAN 2 Rembang has adopted a systemic approach encompassing planning, implementation, evaluation, leadership, and information systems. This aligns with national standards as outlined in the Ministry of National Education Regulation (Permendiknas) No. 19 of 2007, which emphasizes vision-mission-based planning, effective implementation, and accountable supervision (Arikunto, 2017).

However, in the context of digitalizing Islamic Religious Education (PAI) learning, such integration remains limited both technically and pedagogically. This is consistent with (Gusriani et al., 2023), who argue that educational management transformation in madrasahs tends to progress slowly in the digital context due to the uneven mastery of technology among educators.

2. Digital Transformation: From Integration to Pedagogical Innovation

MAN 2 Rembang has demonstrated significant progress at the *integrating* stage, as categorized in UNESCO's digital transformation model, through the use of Exambro, LMS, and other digital systems. However, not all teachers have embraced innovative pedagogical approaches. In many instances, digital media are used merely as technical replacements for conventional tools (e.g., PowerPoint instead of whiteboards), rather than as catalysts for pedagogical transformation.

This reinforces critiques by Aziz et al. (2023) and (Isti'ana, 2024), who assert that digital transformation requires more than tool adoption; it must involve teaching approaches that emphasize interactivity, personalization, and active student engagement. The lack of digital pedagogy training remains a major barrier to reaching the *transforming* stage.

3. Challenges and Inequities in Digital Implementation

Disparities in the implementation of Exambro in the PAI subject group reveal a dual readiness gap—both from the teachers and the students. On one hand, the school management has shown strong commitment through strategic planning, digital curriculum development, and technical training. On the other hand, resistance persists among some PAI teachers who feel uncomfortable or lack confidence in digital approaches. Age, teaching habits, and conventional pedagogical culture are dominant contributing factors.

These findings are consistent with Fadlyani et al. (2023), who emphasize that the success of digitalization is highly influenced by human resource readiness and cultural transformation in teaching. Furthermore, infrastructure and device inequity reinforces the argument by Wening & Santosa (2020) that madrasahs with limited resources are more likely to face obstacles in fully realizing digital programs.

4. Evaluative Dimensions and Digital Accountability

Although regular program evaluations are conducted at MAN 2 Rembang, the absence of a data-driven, documented digital evaluation system means that the process remains largely qualitative and subjective. Teachers have not received specific training in platform-based monitoring or in analyzing learning outcome data. This suggests that the institution is still in a transitional phase concerning digital accountability. According to Fullan (2016) digital transformation model, both infrastructure and the culture of evaluation need to be aligned to fully support institutional change.

5. Strategic Potential and Future Development Directions

Despite the challenges, the study indicates significant potential for strengthening the Digital Madrasah, particularly if the proposed SMART-PAI approach is implemented systematically. This model provides a foundation for digital management innovation based on competency, collaboration, and continuous monitoring. Moreover, students' own enthusiasm for more creative use of digital media suggests that transformation can be accelerated if it adopts a student-centered digital learning approach. In this way, faith-based educational objectives can be harmoniously integrated with modern technological strategies.

Conclusion

MAN 2 Rembang has implemented Digital Madrasah management systematically through planning, execution, and evaluation that adhere to governmental regulations. The revision of its vision-mission and the use of applications such as Exambro and RDM have proven effective in supporting digital administration and learning, despite ongoing challenges such as infrastructure limitations, teacher competence, and data security concerns. The integration of Exambro, beyond serving as an assessment tool, has the potential to become a safe and standardized model for digital PAI learning, which can be replicated with local adaptations.

This study reinforces the discourse on educational innovation management in Islamic education and highlights the importance of strategic, technology-based approaches. It is recommended that the Ministry of Religious Affairs (Kemenag) develop ICT training programs for PAI teachers and promote adaptive digital curricula. Other madrasahs are encouraged to build integrated digital management systems, while future research should explore the long-term impact of technology integration on the quality of PAI instruction.

Declarations

Author contribution statement

All authors contributed significantly to this research. Rida'ul Maghfiroh was responsible for conceptualizing the study, designing the methodology, collecting data, conducting the literature review, interpreting data, analyzing findings, and preparing the discussion and conclusion. Nur Munajat provided direction for the research implementation in accordance with the design and objectives, supervised the research process, contributed to the preparation of the research results, and reviewed the manuscript to ensure the quality of the study. All authors approved the final manuscript and take full responsibility for the integrity and accuracy of the research.

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Data availability statement

The data supporting the findings of this study were obtained through observation, interviews, and documentation at MAN 2 Rembang. Due to institutional policy and confidentiality agreements, the data are not publicly available but may be provided by the corresponding author upon reasonable request. For further information or to request access, please contact the corresponding author via email at 20104010002@student.uin-suka.ac.id.

Declaration of interests statement

The authors declare that they have no competing financial or personal relationships that could have appeared to influence the work reported in this paper. Alternatively, the authors declare the following financial/personal relationships which may be considered potential competing interests.

Additional information

All authors declare that there are no financial, personal, or professional conflicts of interest that could have influenced the results or interpretation of this research.

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