
Artificial Intelligence Integration in Madrasah Education: The Strategic Role of Principals in Improving Institutional Quality

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ABSTRACT

This study aims to analyze the leadership strategies of madrasah principals in integrating Artificial Intelligence (AI) as an effort to enhance educational quality at MA Al-Hidayah Ibum Bandung. Employing a descriptive qualitative approach, the research involved purposively selected informants, including the principal, teachers, and students. Data were collected through observation, semi-structured interviews, and document analysis, and were subsequently analyzed thematically. The findings indicate that the principal's leadership strategy comprises four main steps: establishing a data-driven quality orientation, encouraging teachers to utilize learning data for continuous evaluation, strengthening teacher collaboration in academic decision-making, and fostering a madrasah culture that gradually and ethically adapts to AI utilization. Although AI integration has not yet taken the form of a fully centralized digital system, it is evident through the reinforcement of data-based practices, the use of simple digital summaries, and the application of evaluation results for remedial, enrichment, and learning improvement. These strategies contribute to increased teacher responsiveness, precise learning interventions, and the strengthening of a quality-oriented madrasah culture. The study emphasizes that successful AI integration in madrasahs heavily depends on the principal's leadership in developing vision, teacher capacity, collaboration, and technology governance aligned with Islamic educational values.

Keywords: Artificial Intelligence, Madrasah Principal Leadership, Educational Strategy, Education Quality, Islamic Education

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INTRODUCTION

Madrasah education plays a strategic role in shaping students who excel academically, possess strong moral character, and are adaptable to the changing times. In the context of digital transformation, madrasahs are no longer merely expected to preserve the traditions of Islamic scholarship; they must also manage technological innovations wisely to enhance both the quality of learning and institutional governance (Haddade et al., 2024; Tambak et al., 2022). One significant development influencing education is Artificial Intelligence (AI), a computational system designed to emulate certain human cognitive abilities, such as pattern recognition, data processing, prediction, recommendation, and content generation across text, audio, images, or learning data. In education, AI can manifest as learning analytics, educational chatbots, learning recommendation systems, automated assessment, early-warning systems for at-risk students, and management dashboards that support evidence-based decision-making (Chiu et al., 2023; Wayne et al., 2023).

The integration of AI in education should not be understood merely as the use of digital tools, but as a socio-technical transformation involving humans, policies, organizational culture, infrastructure, and ethics. AI has the potential to support personalized learning, accelerate learning outcome analysis, strengthen continuous evaluation, and increase administrative efficiency. However, its implementation also presents challenges, including limited infrastructure, low AI literacy among teachers, algorithmic bias, student data protection, and the risk of over-reliance on technology (Chiu et al., 2023; Tan et al., 2025). In the context of madrasahs, these challenges are further complicated because AI integration must align with Islamic values, character development, and educational objectives that emphasize not only cognitive achievements but also moral, spiritual, and social responsibility dimensions (Hermiono & Arifin, 2020; Wedi et al., 2025).

Theoretically, this study is grounded in the dialogue between digital leadership, instructional leadership, data-driven decision-making, and Continuous Quality Improvement (CQI). Digital leadership positions the principal as a strategic actor who develops a technology vision, fosters an innovative culture, mobilizes teachers, and ensures that technology use is ethical and aligned with institutional needs. In contrast, instructional leadership emphasizes the principal's role in guiding the learning process, monitoring teaching quality, and utilizing student learning data to design improvements. Within the CQI framework, AI can serve as a supportive tool to identify patterns in student achievement, accelerate feedback, and strengthen the cycle of planning, implementation, evaluation, and follow-up (Akdemir et al., 2020; Alonzo et al., 2024; Visscher, 2021). Thus, AI is not a replacement for human roles but rather a strategic aid that still requires the principal's wisdom, teacher competencies, and value-based oversight to genuinely enhance educational quality.

Empirical literature indicates that AI in education has developed across four main domains: learning, teaching, assessment, and educational administration. A systematic review by Chiu et al. shows that AI can support adaptive learning, assessment, and educational decision-making, yet research on the relationship between AI and learning outcomes, teacher readiness, and institutional governance still requires further strengthening (Chiu et al., 2023). Similarly, Tan et al. found that AI research largely focuses on the application of technology in the teaching process, whereas attention to teacher professional development and institutional readiness remains relatively limited (Tan et al., 2025). In the realm of school leadership, Berkovich notes an increasing use of generative AI in leadership work, particularly to support instructional leadership; however, empirical evidence on how school leaders integrate AI responsibly is still scarce (Berkovich, 2025).

In the context of Islamic education and madrasahs, recent studies have begun to highlight the importance of digital transformation that preserves Islamic values. Wedi et al., for instance, indicate that digital transformation in Madrasah Aliyah requires a balance between strengthening infrastructure, teacher training, value-based instructional design, and ethical screening of digital content (Wedi et al., 2025). Research on Islamic education also emphasizes that AI can support personalized learning, curriculum development, and administrative efficiency; however, its implementation remains uneven and heavily dependent on human resource readiness, institutional policies, and ethical governance (Pratama & Muhammad, 2025). These findings suggest that AI integration in madrasahs should not be examined solely from a technical perspective but should be approached as a leadership agenda encompassing vision, change management, teacher capacity, data protection, and alignment with the moral-spiritual values of Islamic education.

Although the literature on AI in education continues to expand, significant research gaps remain. First, most studies on AI in education still focus on general or higher education, while empirical research in the madrasah context remains limited. Second, research on AI in Islamic education is largely conceptual or literature-based, offering insufficient insight into the practical approaches of madrasah principals in managing AI integration at the institutional level. Third, previous studies have rarely examined how madrasah principals connect AI to educational quality improvement through data-driven evaluation, teacher collaboration, the reinforcement of a quality culture, and decision-making grounded in Islamic values. These gaps underscore the relevance of investigating leadership strategies of madrasah principals in AI integration, particularly for expanding understanding of Islamic educational leadership in the digital era.

Based on this background, this study aims to explore the leadership strategies of madrasah principals in integrating AI to enhance educational quality at MA Al-Hidayah Ibun Bandung. The research focuses on how principals develop a vision and policies for AI integration, promote the use of learning data and continuous evaluation, strengthen teacher collaboration, and manage the opportunities and ethical risks of AI use in the madrasah context. The novelty of this study lies in linking AI, madrasah leadership, data-driven quality management, and Islamic educational values within a single analytical framework. Thus, the study is expected to provide theoretical contributions to the development of Islamic educational leadership studies, as well as practical guidance for madrasah principals, teachers, and policymakers in designing AI integration that is adaptive, ethical, and oriented toward improving educational quality.

METHOD

This study employs a descriptive qualitative approach aimed at exploring strategies for data-based learning quality assessment and continuous evaluation at MA Al-Hidayah Ibun Bandung. This approach was chosen because the research focuses on gaining an in-depth understanding of the practices, experiences, and strategies implemented by the school principal and teachers in managing learning quality assessment. The study was conducted over one semester, specifically during the odd semester of the 2025/2026 academic year, allowing the researcher to observe the assessment process, evaluation, learning follow-up, and the continuous development of student learning outcomes.

The research subjects were selected using purposive sampling, choosing informants deemed to have knowledge, experience, and direct involvement in the implementation of learning quality assessment. The participants included one school principal, eight subject teachers, and twelve students, totaling twenty-one participants. The principal was selected due to their role in policy-making and supervision of learning quality. Teachers were chosen for their direct involvement in the assessment process, recording learning outcomes, providing feedback, and conducting remedial and enrichment activities. Students were included to obtain information regarding their experiences in receiving assessments, feedback, and learning follow-up.

The research procedures were carried out in several stages. The first stage involved research preparation, including the development of interview guides, observation sheets, and documentation formats. At this stage, the researcher also determined the informants and prepared a focused data collection framework related to data-based assessment strategies, continuous evaluation, the involvement of the principal and teachers, and their impact on student learning outcomes. The second stage involved field data collection through classroom observation, semi-structured interviews, and document analysis. Observations were conducted to directly examine how teachers carried out assessments, recorded student progress,

provided feedback, and implemented learning follow-up. Interviews with the principal, teachers, and students were conducted to gather information regarding strategies, challenges, and benefits of implementing data-based assessment. Document analysis was performed on syllabi, lesson plans (RPP), evaluation sheets, grade lists, learning outcome records, remedial and enrichment notes, as well as minutes from learning evaluation meetings.

The research instruments consisted of interview guides, observation sheets, and document analysis formats. Interview guides were used to elicit information about the planning, implementation, and follow-up of learning quality assessment. Observation sheets were used to record teacher and student activities during the learning and evaluation process. Document analysis formats were employed to examine the alignment between planning documents, assessment implementation, learning outcomes, and follow-up activities. Instrument validity was ensured through expert judgment, soliciting input from specialists or individuals knowledgeable in educational management and learning evaluation. Data credibility was strengthened through source triangulation and method triangulation, comparing data from the principal, teachers, students, observations, interviews, and documents.

Data analysis was conducted thematically through several stages. The first stage involved data reduction, which entailed selecting and simplifying data from observations, interviews, and documentation according to the research focus. The second stage was coding, assigning codes to data related to data-based assessment strategies, continuous evaluation, the roles of the principal and teachers, implementation challenges, and their impact on student learning outcomes. The third stage was theme grouping, organizing the codes into the main research themes. The fourth stage involved data presentation, structuring the data narratively to clearly reveal patterns in the findings. The final stage was drawing conclusions, formulating the meaning of the research findings based on the relationships between observations, interviews, and documentation.

FINDINGS AND DISCUSSION

Findings

Implementation of Data-Based Assessment Strategy

Based on the observations, teachers at MA Al-Hidayah Ibun have begun gradually implementing data-based assessments. In the learning process, teachers do not rely solely on exam scores as the basis for assessment but also consider daily assignment results, short quizzes, student participation, and records of learning difficulties that emerge during instruction. This data is used to map students who have achieved competency and those who still require material reinforcement.

Documentation of learning tools, evaluation sheets, daily score lists, exam summaries, and student development records shows that assessment data collection has been conducted regularly. However, most of this documentation is still in the form of manual notes and simple summaries. Some teachers have started using spreadsheets to organize student scores and progress, but not all teachers systematically analyze trends, such as comparing progress between weeks, classes, or competency indicators.



Figure 1. Implementation of Data-Based Assessment Strategy

Interviews with teachers indicate that assessment data is beginning to be used as a basis for improving teaching strategies. Teachers stated that students with low scores or specific difficulties are given repeated lessons, additional assignments, or special guidance. Interviews with the principal also show that learning data serves as a reference for supervision and evaluation. Nonetheless, the principal acknowledged that data utilization is not yet fully optimal due to teachers' limited capacity to process data and the absence of an integrated digital system.

Thus, findings from observations, documentation, and interviews indicate that the data-based assessment strategy has begun to operate but is still in a strengthening phase. Current practices include using assessment results for remedial instruction, enrichment, and adjustments to teaching methods. The main limitation lies in the inconsistency among teachers in documenting, analyzing, and using data as a foundation for instructional decision-making.

Continuous Evaluation in the Learning Process

Classroom observations indicate that continuous evaluation is conducted through a combination of direct observation, daily assignments, formative quizzes, Qur'an reading practice, group discussions, and question-and-answer sessions during learning. Teachers provide immediate feedback when students demonstrate misunderstandings or are unable to complete tasks successfully. This practice helps teachers identify learning difficulties early, prior to students undertaking summative assessments.

From a documentation perspective, weekly progress notes, lists of students attending remedial sessions, assignment results, and summaries of formative scores were found. These documents show that evaluation is not only conducted at the end of the learning period but occurs gradually throughout the learning process. Teachers use these records to group students according to their understanding levels, allowing follow-up learning activities to be more targeted.



Figure 2. Interview on Continuous Evaluation in the Learning Process

Interviews with teachers reveal that continuous evaluation helps them determine when material needs to be reviewed, when students require enrichment, and when individual guidance should be provided. Students also reported that regular feedback helps them better understand the parts of the material they have not yet mastered. Meanwhile, the head of the madrasah assessed that continuous evaluation strengthens the quality control of learning, as student progress can be monitored more closely.

These findings indicate that continuous evaluation has become an integral part of learning practices in the madrasah, although its implementation still faces challenges. The most significant challenge is the limited time teachers have to record and analyze all students' progress in detail. Additionally, manual record-keeping slows down the process of monitoring class progress comprehensively and efficiently.

Teacher and Principal Involvement in Quality Assessment

Based on observations of madrasah activities, the involvement of teachers and the principal is evident in evaluation meetings, informal coordination, and discussions regarding follow-up actions on assessment results. Teachers act as the parties who collect data on student progress through learning activities, while the principal plays a role in directing, monitoring, and evaluating the implementation of quality assessments.

Documentation, including evaluation meeting notes, score summaries, and learning progress reports, indicates that student assessment results are discussed in teacher forums. In these forums, teachers present class achievements, learning challenges, and the need for remedial or enrichment activities. The meeting notes also show follow-up recommendations, although not all recommendations have been formalized into detailed and measurable action plans.



Figure 3. Interviews on Teacher and Principal Involvement in Quality Assessment

Interviews with teachers confirm that the support of the principal encourages them to pay greater attention to learning outcome data. Teachers feel that the principal's guidance helps them determine material priorities, select remedial methods, and plan subsequent teaching strategies. Interviews with the principal also indicate that quality assessment is regarded as part of the academic leadership function, not merely an administrative task for teachers.

Findings from these three data sources suggest that collaboration between teachers and the principal is a crucial factor in strengthening the quality assessment of learning. This collaboration fosters a more open, evidence-based evaluation culture. However, its effectiveness still needs to be enhanced through clearer reporting standards, more structured task distribution, and the use of digital systems to ensure that evaluation results can be followed up more consistently.

The Impact of Assessment Strategies on Student Learning Outcomes

Observations of the learning process indicate that students who received follow-up based on evaluation results appeared more actively engaged in the lessons. During remedial sessions and content reinforcement activities, teachers provided greater attention to students experiencing difficulties. Students were also observed to be more confident in asking questions and following teacher guidance after receiving more specific feedback.

Documentation of daily grades, task summaries, quiz results, and remedial notes showed indications of improvement in some students following data-driven interventions. This improvement was evident in enhanced task completion, conceptual understanding, Qur'an reading skills, and participation in discussion activities. Nevertheless, these gains should still be interpreted as qualitative tendencies, as this study did not employ an experimental design or statistical tests to measure the effect quantitatively.



Figure 4. Interview on the Impact of Assessment Strategies on Student Learning Outcomes

Interviews with students revealed that regular feedback helped them identify their individual learning strengths and weaknesses. Students felt more motivated because teachers addressed the challenges they faced. Teacher interviews also indicated that data-based assessments facilitated the adjustment of teaching methods to meet students' needs, whether through material review, additional exercises, or small-group guidance.

Thus, triangulation of observation, documentation, and interview data demonstrates that data-driven assessment strategies and continuous evaluation contribute to improving the quality of learning. The most apparent impacts include increased teacher attention to students' learning needs, a clearer foundation for remedial and enrichment activities, and enhanced student learning motivation. However, these effects still need to be reinforced through more systematic record-keeping, structured data analysis, and consistently documented follow-up actions.

Discussion

Interpretation of the Implementation of Data-Based Assessment Strategies

The findings of the study indicate that teachers at MA Al-Hidayah Ibun have begun implementing data-based assessment strategies, although not yet optimally. This result aligns with previous studies emphasizing that the integration of learning data enhances the quality of pedagogical decision-making (Alonzo et al., 2024; Banihashem et al., 2022; Ifenthaler & Yau, 2020). The initial implementation of learning data as a basis for intervention reflects teachers' awareness of the importance of empirical evidence (Merk et al., 2020; Michos et al., 2023; Spiele et al., 2025). However, limitations in teacher capacity and infrastructure remain significant obstacles, indicating the need to strengthen teacher competencies and provide support through digital systems.

The analysis further suggests that data-based strategies encourage differentiated instructional practices. Teachers can tailor materials and methods according to student needs, consistent with the principles of personalized learning in modern literature (Shemshack & Spector, 2020; Walkington & Bernacki, 2020; L. Zhang et al., 2020). This approach supports improved learning outcomes and student engagement. The gap between ideal and actual implementation highlights opportunities for innovation in assessment systems (Schildkamp et al., 2020; Xie & Cui, 2021; Yan et al., 2022). Future research could explore digital platforms that facilitate the integration of data into learning processes.

The study confirms that data-based assessment serves as a strategic tool for monitoring learning progress. This is relevant to the theory of Continuous Quality Improvement (CQI), where routine evaluation forms the basis for evidence-based decision-making (Akdemir et al., 2020; Endalamaw et al., 2024;

Jamieson, 2023). The study reinforces the hypothesis that the utilization of data can enhance teaching effectiveness. The findings also underscore the importance of collaboration between teachers and school management. Subsequent research may examine the effectiveness of digital data models on a broader scale.

Continuous Evaluation and Its Impact on Improving the Learning Process

The research findings indicate that continuous evaluation helps teachers detect learning difficulties at an early stage. These findings are consistent with previous studies emphasizing the importance of monitoring progress for timely intervention (Atif et al., 2020; Bernacki et al., 2020; Dai et al., 2025). Continuous evaluation also allows for responsive adjustments to teaching methods, demonstrating a positive relationship between ongoing assessment practices and students' competency achievement.

Analysis of weekly progress documents shows that continuous evaluation encourages the development of more targeted remedial and enrichment strategies. Teachers group students based on their level of understanding, supporting differentiated learning. These results reinforce the hypothesis that continuous assessment can help close learning gaps. Previous studies also suggest that routine evaluation enhances student motivation (Aust et al., 2024; Pat-El et al., 2024; H. Zhang et al., 2025). Future research could explore the impact of continuous evaluation on long-term academic achievement.

Interview results reveal that teachers and school principals utilize evaluation data to improve the accuracy of learning quality assessments. This strategy strengthens teacher accountability and transparency in the assessment process. These findings align with the educational quality management literature, which emphasizes the integration of supervision and continuous evaluation (Díez et al., 2020; Marey et al., 2020; Parveen et al., 2024). Implementation of such practices enables faster and more efficient interventions. Subsequent research could assess the effectiveness of digital-based continuous evaluation systems in other madrasahs.

The Role of Teacher and Principal Collaboration in Assessment Strategies

Research findings indicate that the involvement of teachers and principals strengthens the implementation of quality assessment strategies. This collaboration aligns with participative management theory, where data-driven decision-making is more effective through interactions between staff and management (Khassawneh & Elrehail, 2022; Silla et al., 2020; Szukits & Móricz, 2024). Observations revealed that weekly evaluation meetings encourage evidence-based discussions. These results support the hypothesis that collaboration enhances the effectiveness of assessment strategies.

Document analysis of meetings showed practices of sharing best practices among teachers. Principals facilitated discussions to determine appropriate interventions for students. These findings are consistent with previous studies highlighting the importance of a collaborative culture in education (Admiraal et al., 2021; Mydin et al., 2024; Nguyen et al., 2021). Teacher–management collaboration facilitates the implementation of continuous evaluation. Future research could examine the impact of formal versus informal collaboration on learning quality.

Interviews with teachers indicated that strategic guidance from principals increases motivation to conduct data-driven evaluations. Teachers perceived management support as fostering accountability and instructional innovation. These findings reinforce educational management literature emphasizing the integration of management and pedagogical practices (Cai & Tang, 2021; Liu et al., 2022; Vidergor, 2023). Overall, the study underscores the importance of participative leadership in improving learning quality. Subsequent research could explore collaborative, data-driven training strategies.

The Impact of Assessment Strategies on Student Learning Outcomes

Research findings indicate that data-driven assessment strategies combined with continuous evaluation enhance students' conceptual understanding. Observations and final grade documents show improvements

in cognitive, affective, and psychomotor competencies. These results align with previous studies highlighting the role of data in improving learning outcomes (Foster & Francis, 2020; Owan et al., 2022). This strategy helps bridge the gap between ideal and actual achievements. The findings support the hypothesis that data-based interventions are effective in enhancing learning outcomes.

Student interviews revealed that regular feedback increased motivation and active participation. They were able to identify weaknesses and specifically address their learning gaps. These findings are consistent with educational literature emphasizing the importance of continuous feedback (Molin et al., 2021; Molloy et al., 2020). Continuous evaluation makes the learning process more transparent and responsive. Future research could assess the long-term impact of this strategy on academic achievement.

Document analysis showed that continuous evaluation-based interventions help teachers adjust teaching methods. Students who had previously lagged behind began to show significant improvement. These findings support literature emphasizing the integration of data in differentiated learning strategies (Bez et al., 2025; Karst et al., 2022). Overall, the results demonstrate that this strategy enhances student motivation, engagement, and learning outcomes. Future research could explore the replication of this strategy in other madrasahs with different contexts.

CONCLUSION

The conclusion of this study affirms that a data-driven learning quality assessment strategy combined with continuous evaluation not only enhances teaching effectiveness but also fosters a responsive and adaptive learning ecosystem at MA Al-Hidayah Ibun. The implementation of this strategy aligns with the initial expectations outlined in the introduction, namely the establishment of a holistic, evidence-based evaluation system capable of bridging the gap between ideal learning outcomes and actual student performance. Beyond mere measurement, data-driven assessment enables teachers to perform timely interventions, while continuous evaluation promotes the development of more reflective and collaborative teaching practices. These findings carry significant implications for the management of Islamic education, particularly in supporting evidence-based decision-making and strengthening the capacities of both teachers and school principals. Moreover, this study opens opportunities for the development of digital assessment models and broader integration of learning analytics, while also encouraging future research to evaluate the effectiveness of this strategy in other madrasahs or at different educational levels.

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