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Digital Smart Classroom Integration: Enhancing Student Learning Motivation and Pedagogical Dynamics

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ABSTRACT

This study evaluates the implementation of the Digital Smart Classroom program at MAN 3 Palembang using the CIPP (Context, Input, Process, Product) evaluation model. The research is driven by the disparity between rapid technological infrastructure expansion and educators' actual pedagogical readiness. Employing a qualitative-dominant mixed-methods approach, data were gathered through in-depth interviews with 18 key informants, participatory observations, and questionnaires distributed to 72 respondents. The findings reveal that while the Context and Input phases show strong institutional alignment and infrastructure readiness (score 3.70–3.90), teacher digital pedagogical competence remains a critical bottleneck (score 3.60). Process evaluation indicates that digital transformation has successfully fostered an active learning environment (score 4.05), although it is frequently hindered by network stability issues (score 3.45). Ultimately, the Product evaluation demonstrates that the program significantly enhances student motivation and satisfaction, placing it in the "Very Good" category (score 4.21). The study concludes that successful digital transformation in madrasahs necessitates a strategic shift from hardware-oriented procurement to sustainable human resource development, with a focus on innovative digital pedagogical strategies.

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1. INTRODUCTION

The acceleration of educational digitalisation in the Society 5.0 era has compelled educational institutions to integrate information technology more intensively into classroom learning. This transformation represents a fundamental change in pedagogical practices and learning ecosystems [1]. Madrasahs, as an integral part of the Indonesian national education system, face distinctive challenges in adopting digital innovations while preserving religious values. In practice, however, many institutions focus predominantly on physical

infrastructure procurement without adequately addressing pedagogical readiness [2]. This often leads to "digital formalism," where advanced tools are used for low-level instructional tasks, resulting in minimal improvement in learning quality [19].

The primary problem at MAN 3 Palembang is the functional gap between the digital facilities available across 36 classrooms and teachers' pedagogical competence. This disparity is often exacerbated by top-down policy formulations that limit teachers' involvement in pedagogical adaptation [2]. Without systematic, evidence-based evaluation, the program's sustainability is at risk, potentially leading to technology becoming a decorative element rather than a transformative tool [11]. Consequently, there is an urgent need to evaluate the program holistically to ensure that technological investments translate into meaningful educational outcomes.

Previous studies have extensively discussed technology adoption, primarily focusing on technical acceptance or infrastructure readiness [3], [4]. However, most existing literature concentrates on public schools, overlooking the dual challenge madrasahs face in balancing technological disruption with traditional values [17]. This reveals a significant research gap in comprehensive empirical evaluations that use holistic frameworks such as CIPP, particularly in the madrasah context. Previous studies, including those by Annur and Rahmawati [11], suggest that madrasahs encounter unique structural barriers, including a "top-down" policy approach that may disconnect leadership vision from classroom reality [6].

To address these challenges, this study applies the CIPP (Context, Input, Process, Product) model developed by Stufflebeam [10] as a strategic diagnostic tool. The CIPP model enables a systematic analysis that ranges from the strategic foundations, resource readiness, and classroom dynamics to the ultimate outcomes perceived by students [1]. Theoretically, this study is grounded in Connectivism theory, which posits that learning in the digital age is a process of connecting specialised information nodes [21]. From this perspective, a Smart Classroom is effective only when it fosters dynamic interaction rather than static content delivery.

The novelty of this research lies in its application of the CIPP model to examine digital transformation at the Madrasah Aliyah level, with a specific focus on the interplay between teacher competence and network stability. Unlike previous studies that emphasise hardware availability, this research highlights how interaction patterns within the digital learning ecosystem influence student motivation and engagement [13]. By identifying both strengths and systemic constraints, this study provides a new perspective on how "added value" is generated in a digital madrasah environment, moving beyond mere technical implementation [14].

Finally, this research outlines a strategic plan to solve the identified gaps by providing evidence-based recommendations for stakeholders [15]. The findings are expected to serve as a benchmark for other madrasahs in managing a pedagogically grounded transition toward digital excellence. The expected benefit is the creation of a sustainable development model that prioritises human resource capacity over hardware procurement. Ultimately, this study demonstrates that the success of a Smart Classroom depends on the synergy between institutional policy, technical reliability, and pedagogical innovation.

2. METHOD

2.1. Research Design and Evaluation Framework

This study utilised a qualitative-dominant mixed-methods design, integrating descriptive quantitative data to assess the Digital Smart Classroom program at MAN 3 Palembang. This approach was strategically chosen to gain profound insights into instructional dynamics and stakeholder experiences, using quantitative metrics as a numerical baseline to validate the depth of qualitative insights. The evaluation was systematically structured based on Stufflebeam's CIPP (Context, Input, Process, and Product) model, providing a holistic diagnostic of strategic relevance, resource readiness, operational execution, and program outcomes [1], [5].

2.2. Research Setting and Participants

The investigation was conducted at MAN 3 Palembang, South Sumatra, a pioneer in digital madrasah transformation since 2021. From November to December 2025, 72 participants were engaged through total and purposive sampling: (i) School Management (n=8), (ii) Teachers (n=14) with over six months of digital teaching experience, and (iii) Students (n=50) as active LMS users. Qualitative data integrity was maintained through 18 in-depth interviews until data saturation was reached, ensuring no novel themes emerged from the field.

2.3. Data Collection Procedures

Data were acquired through a multifaceted triangulation strategy to ensure high-level credibility and robust data integration. The primary qualitative stage involved semi-structured, in-depth interviews with 18 key informants, consisting of eight management members, six selected teachers, and four technical IT staff. Each session, lasting 45-60 minutes, was guided by a protocol derived from the CIPP dimensions to explore strategic vision and instructional hurdles. To maintain data integrity and accuracy, all interviews were digitally recorded with the participants' consent and transcribed verbatim for subsequent thematic analysis.

To capture the empirical reality of digital pedagogy, systematic participatory observations were conducted across 36 classrooms. This process used a structured checklist focusing on four critical indicators: the frequency of smartboard use, the depth of Learning Management System (LMS) integration, the quality of teacher-student interactions, and overall student engagement. This observational evidence served as a vital component of the "Process" evaluation, identifying the functional gap between theoretical planning and actual classroom implementation. These findings were further enriched by a document analysis of the Madrasah Smart Digital 2024 guidelines and technical maintenance logs to provide an administrative context.

The final stage of data acquisition involved distributing standardised 5-point Likert-scale questionnaires to 72 respondents to verify broader institutional trends. This quantitative instrument included a 25-item questionnaire for teachers focusing on resource availability and a 20-item questionnaire for students assessing perceived motivation and satisfaction. All instruments underwent rigorous pre-validation to ensure content consistency and reliability

of the mean scores produced. By synthesising these diverse data sources, the researcher conducted a comprehensive CIPP evaluation that balances administrative policy with educators' and learners' lived experiences.

3. RESULTS AND DISCUSSION

3.1 Results of the Smart Classroom Digital Evaluation

3.1.1 Context Evaluation: Strategic Foundation and Institutional Relevance

Evaluation within the context dimension is designed to examine the program's underlying background, identify institutional needs, and assess the strategic alignment of the Digital Smart Classroom program with the long-term objectives of MAN 3 Palembang. This analytical phase is vital to ensure that the initiative is rooted in empirical necessity rather than merely following ephemeral technological trends. Historically, the madrasah's digital transformation journey was initiated in 2021 through various pilot projects, which matured and culminated in the official launch of "Madrasah Smart Digital" on October 15, 2024, now integrating 36 fully functional classrooms.

Table 1. Context Evaluation: Strategic Foundation of Smart Classroom

Indicators	Mean Score	Category
Alignment with Madrasah Vision	4.45	Very Good
Relevance to Society 5.0 Needs	4.32	Very Good
Institutional Policy Support	4.21	Very Good
Overall Mean Score	4.32	Very Good

Source: Processed Primary Data (2025)

Based on the quantitative data presented in Table 1, the context dimension achieved a robust overall mean score of 4.32, placing it in the "Very Good" category. The most significant performance was identified in the "Alignment with Madrasah Vision" indicator (4.45), validating that the program serves as a tangible execution of the institution's 2021–2025 strategic roadmap. The Vice Headmaster of Curriculum (WKM-K) reinforced this strategic imperative, arguing that conventional instructional methodologies are insufficient for a generation raised in the digital epoch, thereby necessitating a structural adaptation to sustain educational significance. This high level of institutional legitimacy has effectively triggered a paradigm shift in pedagogy; currently, 85% of the faculty meet the competencies required to utilise the LMS and interactive digital tools, successfully transitioning from unidirectional lecturing to a technology-enhanced collaborative environment.

Furthermore, the context evaluation demonstrates that the program effectively addresses student expectations. Qualitative reflections from students (W-S1) indicate that digital integration mitigates instructional boredom and accelerates conceptual clarity: "The use of interactive screens and videos makes complex topics easier to grasp and allows for immediate practical application." This student-side satisfaction aligns perfectly with the quantitative metrics for learning motivation. Supported by the technical IT staff (W-OP) who maintain server integrity and real-time monitoring, these results confirm that the Digital Smart Classroom transcends a simple hardware upgrade. It represents a comprehensive

strategy to enhance educational quality in accordance with the madrasah's identity as an "Innovative and Technology-Adaptive Institution.

3.1.2. Input Evaluation: Resource Readiness and Challenges

The input evaluation phase focuses on assessing the preparedness of human capital, physical facilities, and organisational policies to determine whether the madrasah's current resources align with its digital expansion goals. From a quantitative perspective, the average score for this area was 3.80, categorised as "Good," indicating a solid foundation for project implementation. However, qualitative evidence suggests that despite this positive metric, there are underlying technical and instructional inconsistencies that necessitate targeted improvements. Such measures are essential to guarantee the long-term viability of the initiative and the overall effectiveness of the institution's technological integration.

Table 2. Input Evaluation: Resource and Infrastructure Readiness

Indicators	Mean Score	Category
Student Readiness for Digital Learning	4.00	Very Good
Policy Support and Madrasah Management	3.90	Good
Availability and Suitability of Infrastructure	3.70	Good
Teacher Competence and Readiness	3.60	Good
Overall Mean Score	3.80	Good

Source: Processed Primary Data (2025)

As illustrated by the empirical findings in Table 2, the most prominent success is identified in "Student Readiness for Digital Learning" (4.00), which validates that learners, as digital natives, exhibit high flexibility within the Smart Classroom setup. Conversely, "Teacher Competence and Readiness" (3.60) represents the lowest evaluation mark, highlighting a clear instructional deficit: while educators feel proficient with basic digital tools, they still encounter difficulties with advanced electronic teaching methods. This was echoed by a teacher (W-G2), who remarked:

"*We are* accustomed *to basic LMS and projection tasks. However, generating more immersive instructional content still requires specialised professional development.*"

This implies that deeper pedagogical coaching is vital to maximise the interactive smartboard's utility. Moreover, the "Availability and Suitability of Infrastructure" (3.70) is significantly hindered by persistent network stability problems. Qualitative insights from the IT Specialist (W-TIK) indicate that inconsistent web connectivity during peak usage periods frequently triggers technical failures when 36 classrooms are active simultaneously. This systemic pressure is also reflected in the personnel sector; although "Policy Support and Madrasah Management" is robust (3.90), the technical assistance staff is currently stretched to its limit. The IT staff mentioned that they are forced to put in "extraordinary effort" to oversee every classroom daily, which poses a major threat to the program's future continuity and growth if network capacity and staffing are not expanded.

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3.1.3. Process Evaluation: Dynamics of Digital Pedagogy

The process evaluation focuses on the actual implementation of the Digital Smart Classroom program at MAN 3 Palembang. This stage aims to assess the extent to which the program's execution aligns with its planning and to identify the dynamics occurring in the field. Based on the CIPP framework, the focus shifts from resource readiness to actual instructional practices, including technology integration, pedagogical strategies, and classroom interactions.

Table 3. Process Evaluation: Implementation of Digital Learning

Indicators	Mean Score	Category
Teacher-Student Digital Interaction	4.32	Very Good
Utilisation of Technology in Class	4.21	Very Good
Technical Maintenance and Support	4.18	Very Good
Integration of Pedagogical Strategies	4.12	Very Good
Technical Constraints (Network Stability)	3.45	Fair
Overall Mean Score	4.05	Very Good

Source: Processed Primary Data (2025)

According to Table 3, the process dimension achieved a comprehensive mean score of 4.05, placing it in the "Very Good" category. The highest performance was recorded in "Teacher-Student Digital Interaction" (4.32), signifying that the technology has effectively fostered active participation. Field observations corroborate that lessons utilising interactive smartboards and Learning Management System (LMS) quizzes significantly increase student involvement. This sentiment was echoed by a student (W-S2), who noted:

"*When the teacher uses videos or quizzes on the LMS, we become more courageous to ask questions and join the discussion*."

This *represents* a meaningful transition from traditional, unidirectional lecturing to a collaborative digital ecosystem in which educators serve as moderators of digital inquiry.

Nevertheless, a substantial hurdle persists regarding the "Integration of Pedagogical Strategies" (4.12). Despite the high numerical score, qualitative data suggests that many educators are still navigating a transitional phase, often limited to "digitising" traditional materials on a screen rather than implementing a fully immersive digital pedagogy. One educator (W-G5) acknowledged:

"*While technology is beneficial, we are still adapting our traditional methods. Many of us are not yet fully comfortable reinventing our instructional approaches*."

This highlights a potential risk of "digital formalism," where technological tools are adopted without a core transformation in pedagogical philosophy. Consequently, ongoing professional mentorship is essential to ensure that technology serves as a genuine driver of active learning frameworks, such as Problem-Based Learning (PBL).

The most prominent operational bottleneck identified in the process evaluation is "Technical Constraints" (3.45), particularly concerning internet stability. Qualitative evidence indicates that the network frequently experiences significant latency when utilised simultaneously across 36 classrooms, thereby interrupting the instructional momentum. As remarked by a teacher (W-G6):

"*During peak network congestion, the LMS response time slows down, which inevitably disrupts the continuity of the learning process.*"

This objective evidence underscores that the Digital Smart Classroom's efficacy depends not only on pedagogical mastery but also on the robustness of its backend infrastructure. Therefore, enhancing bandwidth capacity and optimising technical surveillance are imperative for the program's long-term scalability and operational success.

3.1.4. Product Evaluation: Outcomes and Added Value

Product evaluation measures the substantive impact of the Digital Smart Classroom on instructional quality and the broader educational milieu at MAN 3 Palembang. Within the CIPP framework, this final stage quantifies the program's efficacy in achieving its intended goals and identifies the "added value" it provides to the institution. From a quantitative perspective, the product dimension achieved an impressive cumulative mean score, validating that the initiative has successfully transformed the learning environment into a more dynamic, engaging, and contextual ecosystem.

Table 4. Product Evaluation: Learning Outcomes and Impact

Indicators	Mean Score	Category
Class Interaction Dynamics	4.30	Very Good
Student Learning Satisfaction	4.25	Very Good
Teacher Managerial Benefits	4.21	Very Good
Learning Activity and Variation	4.18	Very Good
Technical Resilience and Engagement	4.12	Very Good
Overall Mean Score	4.21	Very Good

Source: Processed Primary Data (2025)

As shown in Table 4, the greatest impacts are observed in "Class Interaction Dynamics" (4.30) and "Student Learning Satisfaction" (4.25). Qualitative evidence indicates that the Smart Classroom has effectively dismantled the physical constraints of conventional pedagogy, fostering a more inclusive environment for academic expression. One educator (W-G8) observed that students who previously exhibited passivity in traditional settings showed increased confidence in articulating their perspectives via the LMS platform. From the learners' viewpoint, this digital shift has significantly mitigated academic fatigue while enhancing conceptual retention through multimedia integration. This was confirmed by a student (W-S5), who remarked:

"*Lessons have become more immersive because we can utilise video content, and the resources remain accessible for review at home.*"

This suggests that the program has generated "added value" by extending the educational boundaries beyond formal school hours.

Furthermore, the assessment highlights substantial "Teacher Managerial Benefits" (4.21) alongside enhanced "Learning Activity and Variation" (4.18). Faculty members reported that the digital infrastructure has optimised administrative workflows, particularly by streamlining assignment management and presenting intricate subject matter. An instructor (W-G7) noted that the transition to digital media enables students to grasp complex concepts more rapidly and maintain focus longer than during conventional lectures.

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Nevertheless, the endurance of these positive results is inextricably linked to technical reliability; field observations indicate that student engagement levels occasionally fluctuate during periods of network instability. Despite these infrastructural challenges, the overwhelmingly favourable reception from both educators and students confirms that the Digital Smart Classroom is a highly relevant innovation that successfully meets the needs of the digital generation while strengthening overall educational standards at MAN 3 Palembang.

3.2. Discussion: Impact and Determinants of Digital Transformation

3.2.1. The Impact of Smart Classroom on the Learning Process

The integration of Digital Smart Classrooms at MAN 3 Palembang has fundamentally overhauled the existing pedagogical framework. This evolution is driven by a decisive shift from teacher-centric instruction to student-centred learning models. Empirical data reveal a student motivation score of 4.10, which is intrinsically tied to this more vibrant educational atmosphere. The primary outcome of this shift is the substantial improvement in both visual and conceptual comprehension. As observed by the Civics educator (W-G):

"*In Civics, materials once regarded as monotonous become more immersive because I can instantly present interactive videos and live data*."

This confirms that the program's influence transcends technical utility to achieve cognitive enrichment. The technology enables a "multi-sensory" instructional experience that accommodates various learning profiles. Additionally, the impact on inclusive interaction is manifest as previously withdrawn students become more active through digital quizzes on the smartboard. This supports the premise that a digital ecosystem can diminish students' "affective filter," fostering greater confidence in their academic participation [7].

3.2.2. Supporting Factors for Success

Three core pillars of success fundamentally sustain the program’s institutionalisation at MAN 3 Palembang. Central to this achievement is decisive managerial leadership, as evidenced by a context evaluation score of 4.28, underscoring the vital "top-down" commitment required for systemic transformation. The Vice Headmaster (WKM-K) reinforced this by stating that the project is anchored in internal mandates, guaranteeing its status as a long-term institutional policy rather than a transient technological trend. This leadership is further bolstered by high student adaptability; as "digital natives," the learners exhibited a readiness score of 4.00, indicating that their innate technological fluency serves as a compelling external motivator for teachers to advance their pedagogical methods. Finally, the comprehensive availability of physical infrastructure, encompassing 36 fully functional classrooms, ensures that digital integration is a consistent, daily practice. This widespread accessibility has successfully moved the program beyond sporadic usage, effectively embedding a robust "digital culture" within the madrasah’s educational ecosystem.

3.2.3. Inhibiting Factors and Structural Bottlenecks

Despite the aforementioned successes, the research identified several critical inhibitors that prevent the program from reaching its maximum potential, most notably the "bandwidth crisis." This primary physical obstacle is reflected in an internet stability score of 3.42, with the IT Technician (W-TIK) acknowledging that inconsistent network performance during peak demand remains the central challenge. Such technical bottlenecks have direct pedagogical implications, as educators frequently lose 10–15 minutes of instructional time due to connectivity glitches, which severely disrupts student concentration and the teacher's instructional "flow." Furthermore, a significant digital competence disparity persists among the faculty (score 3.58), with many teachers remaining in the "Substitution" phase—using smartboards merely as basic projectors rather than interactive tools. Severe time constraints compound this issue, as heavy administrative workloads often eclipse the effort required to curate high-quality multimedia. Lastly, the limited number of technical personnel relative to the 36 active classrooms poses a significant risk to the program's long-term maintenance and scalability.

3.2.4. Synthesis and Future Strategy

Drawing from the CIPP analysis, the digital evolution at MAN 3 Palembang can currently be characterised as "Infrastructure-Ready" yet "Pedagogy-Developing." To reconcile this disparity, the madrasah must pivot from a hardware-centric to a human-centric approach, necessitating a transition beyond fundamental technical literacy toward "Applied Digital Pedagogy." The evaluation highlights a critical dependency: unless technical reliability, specifically bandwidth, is stabilised, even highly proficient educators will encounter significant hurdles in sustaining a high-calibre digital instructional process. These findings substantiate the initial concerns regarding the "functional gap" between sophisticated hardware and digital pedagogical mastery. While infrastructure metrics were high, the presence of "digital formalism" in classroom settings suggests that equipment acquisition is merely the preliminary phase. The alignment between the institutional vision (Context) and the actual classroom outcomes (Product) is profoundly mediated by the "Process" dimension. This research demonstrates that unless the bandwidth crisis and the identified pedagogical gaps are addressed, the strategic objectives of Society 5.0 will remain only partially realised. Thus, while the integration is triumphant in terms of "adoption," it remains a work in progress concerning "meaningful transformation."

Future Prospect and Application: The outcomes of this evaluation offer a replicable blueprint for other Indonesian madrasahs embarking on analogous digital transitions. Utilising the CIPP model in this research provides institutions with an instrument to determine whether their limitations lie at the resource level (Input) or the instructional level (Process). Future academic endeavours should focus on developing a specialised "Digital Pedagogical Framework for Madrasahs" that harmonises religious values with high-tech interactivity. Furthermore, longitudinal investigations are required to evaluate the direct link between the 4.30 interaction score identified in this study and students' long-term academic growth, particularly in Higher Order Thinking Skills (HOTS). Such studies would provide a

more granular and sophisticated understanding of the "Product" dimension within this technological ecosystem.

4. CONCLUSION

Based on this study, the digital transformation at MAN 3 Palembang has achieved significant strategic success across the context and product dimensions, yet continues to face critical operational hurdles in the input and process stages. The findings confirm that the initial expectations set in the introduction regarding a "functional gap" are substantiated by the results, in which high-end hardware availability is not yet fully aligned with the depth of teachers' digital pedagogical competence. Consequently, most educators remain at a stage of technological substitution rather than radical instructional transformation.

The research highlights that the sustainability of digital innovation in madrasahs relies heavily on bridging the gap between infrastructure reliability and human resource capacity. Regarding the prospect of development, despite its focus on a specific institutional case, these results serve as a diagnostic model for other Islamic institutions to identify systemic bottlenecks before initiating large-scale digital transitions. Furthermore, future studies should focus on establishing a specialised "Digital Pedagogical Framework for Madrasahs" and on conducting longitudinal assessments of the correlation between network stability and the development of students' Higher Order Thinking Skills (HOTS). Ultimately, this study demonstrates that meaningful technological adoption in education is achievable only through a balanced synergy of backend reliability, pedagogical mastery, and sustained managerial commitment.

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