



Integrating Scientific Values into the Islamic Religious Education Curriculum: Pedagogical Innovations and Implementation Challenges

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Abstract

This study aims to analyze the integration of scientific values into the Islamic Religious Education (PAI) curriculum alongside its corresponding pedagogical innovations and implementation barriers. However, a persistent structural dichotomy between normative religious instruction and empirical scientific reasoning continues to impede holistic curriculum development in Islamic secondary schools. Employing a qualitative case study design, this research investigated authentic classroom practices and administrative structures within the school environment. Data were gathered using semi-structured interviews with key educational actors, non-participant field observations, and extensive curriculum document analysis. The collected qualitative data were systematically processed using Miles, Huberman, and Saldana's interactive analysis model, encompassing data condensation, structured data displays, and continuous conclusion verification. The findings reveal that contextualizing Quranic scientific verses through inquiry and project-based learning transforms traditional PAI into an active analytical discipline. Hands-on greenhouse experimentation and laboratory water testing successfully bridge scriptural exegesis with empirical scientific investigation. Students demonstrate heightened critical thinking and deeper spiritual reflection when analyzing natural phenomena through integrated project-based assignments. Future research should conduct multi-site mixed-methods evaluations to develop standardized interdisciplinary professional development frameworks for religious educators across diverse Islamic educational contexts.

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Introduction

The integration of scientific values into Islamic Religious Education (PAI) curricula is increasingly vital for fostering a society capable of harmonizing spiritual ethics with modern empirical inquiry (Suyatno et al., 2022; Wahyuni et al., 2025). Preparing a generation that possesses both solid moral character and scientific literacy is essential for driving sustainable social transformation amidst rapid global technological advancement (Abbasi, 2021; Sabic-El-Rayess, 2020). Grounded in holistic educational frameworks, embedding scientific attitudes—such as empirical inquiry, logical reasoning, objectivity, and evidence-based problem-solving—into religious instruction prevents intellectual dogmatism and strengthens societal resilience against misinformation (Pathollah et al., 2025). The phenomenon demonstrates that educational systems harmonizing faith-based values with scientific methodologies produce learners who excel in both ethical reasoning and critical technological adaptability. Consequently, modernizing religious curricula to encompass scientific principles is of paramount importance for broader societal development. Establishing an integrated pedagogical framework directly safeguards public intellectual progress, promotes religious moderation, and ensures that faith-based education remains actively relevant to contemporary global challenges. Therefore, analysing the synthesis of science and Islamic values remains crucial for cultivating an enlightened, ethical, and scientifically minded populace.

Despite the urgent societal need for integrated learning, contemporary education systems frequently struggle with a deep structural dichotomy between religious instruction and scientific reasoning. A major societal problem is that traditional Islamic education often operates in isolation from empirical scientific principles, leading to an intellectual disconnect among youth facing complex modern dilemmas (Pathollah et al., 2022). Many instructional frameworks treat religious studies as purely normative, rote-memorization subjects focused solely on ritualistic compliance, while ignoring the rich historical tradition of scientific inquiry within Islamic civilization. This rigid separation leaves students ill-equipped to critically analyse contemporary socio-technological issues, such as bioethics, digital literacy, and environmental sustainability, through an integrated ethical-scientific lens (Ansari & Muhlis, 2026; Ilmah & El Yunusi, 2026). Concurrently, public discourse is increasingly fragmented by dogmatic polarization and scientific scepticism, exacerbated by inadequate educational synthesis at the primary and secondary levels. When religious education fails to cultivate scientific inquiry and rational analysis, broader society suffers from intellectual stagnation, reduced analytical capacity, and an inability to leverage faith-based ethics to resolve real-world scientific and technological challenges.

At the operational level within primary and secondary schools, this educational dichotomy is vividly apparent in daily classroom practices. Field observations reveal that PAI teachers predominantly rely on traditional, teacher-centre instructional methods, focusing almost exclusively on text-based memorization of scriptural verses, jurisprudence rules, and historical narratives without contextualizing them alongside scientific principles. Although national

curriculum standards encourage higher-order thinking skills, religious educators rarely incorporate hands-on scientific inquiry, evidence-based discussions, or interdisciplinary project-based learning into their lessons (Sembiring et al., 2026). Furthermore, interviews with instructional staff highlight severe pedagogical barriers, including a prevalent misconception that scientific inquiry threatens religious orthodoxy, a lack of specialized training in interdisciplinary teaching methods, and insufficient instructional modules designed to merge religious doctrines with empirical science. These empirical conditions illustrate a profound operational gap: while educational policies advocate for holistic student development, actual classroom execution remains heavily constrained by fragmented syllabi, pedagogical resistance, and teaching strategies that fail to connect Islamic ethics with modern scientific phenomena.

Prior scholarly literature on Islamic curriculum development has primarily focused on isolated pedagogical aspects rather than a comprehensive synthesis of scientific inquiry and religious instruction. Studies such as those by Solehuddin et al., (2024) demonstrated that project-based learning in PAI enhances student creativity, yet their analysis remained limited to general soft skills without explicitly embedding scientific methods. Similarly, research conducted by Pritchett & Sandefur, (2020) explored digital literacy within religious studies but focused narrowly on social media etiquette rather than integrating formal scientific inquiry into the curriculum core. Additionally, Chanifah, (2026) and Zuhdi, (2018) examined religious moderation and communication skills, leaving a significant analytical gap regarding how empirical scientific values—such as hypotheses testing, critical observation, and systematic analysis—can be systematically woven into Islamic religious education. Consequently, existing scholarship reveals a critical research gap: it consistently lacks a holistic framework that addresses both the conceptual alignment of scientific values with Quranic principles and the concrete pedagogical innovations required to overcome real-world teacher implementation barriers.

Furthermore, existing studies frequently treat implementation challenges as minor administrative obstacles rather than deep-seated pedagogical and epistemological hurdles requiring structured intervention strategies. To fill these critical literature gaps, this study offers a novel conceptual and practical framework that systematically aligns scientific values with Islamic religious instruction through innovative, interdisciplinary pedagogical strategies. The state of the art of this research lies in its comprehensive approach, examining not only the theoretical alignment between Quranic tenets and scientific inquiry but also evaluating field-level pedagogical innovations—such as science-integrated problem-based learning and interdisciplinary modules—designed to resolve implementation resistance. Resolving this issue is urgently necessary because continuing to teach religious education without scientific integration risks rendering PAI obsolete in an era dominated by technological advancements and scientific complexity. By establishing a robust, integrated framework, this study advances current curriculum theory, offering actionable mechanisms to transform religious instruction into a dynamic platform for both moral grounding and scientific literacy.

To address these persistent gaps, this study investigates how scientific values can be effectively integrated into the PAI curriculum, evaluating the pedagogical innovations required and the structural challenges educators face during implementation. We argue that embedding scientific inquiry into Islamic religious education does not dilute faith, but rather enriches spiritual understanding, elevates critical thinking, and mitigates instructional dichotomy when supported by interdisciplinary learning models and targeted teacher professional development. By systematically combining Quranic principles with empirical reasoning, religious instruction can successfully foster analytical, morally grounded learners equipped for modern challenges. This research offers significant theoretical and practical contributions to educational leadership and curriculum design. Theoretically, it expands integrated curriculum theory within Islamic education by bridging epistemological divides between faith and reason. Practically, it provides actionable guidelines, interdisciplinary module frameworks, and policy recommendations for curriculum developers, school principals, and the Ministry of Education to modernize PAI instruction, empower teachers, and enhance student engagement nationwide.

Methods

This study employed a qualitative case study design to investigate the integration of scientific values into the Islamic Religious Education (PAI) curriculum within an authentic school environment. A qualitative case study approach was selected because it facilitates an in-depth, holistic exploration (Creswell, 2007; Marx, 2023) of complex pedagogical innovations, teacher perceptions, and contextual challenges that quantitative methodologies cannot adequately capture. The research was conducted at Islamic Senior High School of Nurul Latif Bondowoso, intentionally chosen as the research locus due to its unique institutional commitment to combining Islamic boarding school values with modern scientific curricula, alongside its ongoing initiatives in developing interdisciplinary teaching models. Data collection involved three key techniques: semi-structured in-depth interviews with PAI teachers, the school principal, and curriculum coordinators; non-participant classroom observations focusing on scientific-religious integration practices; and document analysis of syllabi, lesson plans (RPP/Modul Ajar), and student assessment tools. Informants were selected via purposive sampling, prioritizing key educational actors directly involved in designing and implementing integrated learning strategies within the school.

Data analysis followed the interactive model by Miles, Huberman, and Saldana, comprising data condensation, data display, and conclusion drawing or verification (Thompson Burdine et al., 2021). Data condensation involved systematically selecting, simplifying, categorizing, and transforming raw field notes, interview transcripts, and curriculum documents to isolate core themes regarding pedagogical innovations and implementation barriers. Condensed findings were organized into structured thematic data displays, including narrative matrices and thematic networks, to clearly illustrate instructional patterns and pedagogical bottlenecks.

Conclusions were continuously verified through iterative cross-referencing with field evidence to establish grounded explanation. To ensure data trustworthiness and credibility, the research employed rigorous triangulation techniques, including source triangulation by comparing perspectives across teachers, administrators, and students, and methodological triangulation by cross-examining interview data against observational logs and physical curriculum artefacts. Additionally, member checking was conducted with key participants to confirm transcript accuracy, while prolonged field engagement ensured the transferability, dependability, and confirmability of the research findings.

Finding and Discussion

Finding

Contextualizing Quranic Scientific Verses Through Inquiry and Project-Based Learning

At the locus of this research, contextualizing Quranic scientific verses through inquiry and project-based learning (PBL) is an integrative pedagogical framework that connects scriptural texts with empirical scientific exploration. Rather than treating Islamic Religious Education (PAI) purely as a normative or text-based subject, educators actively engage students in scientific methodologies—such as systematic observation, hypothesis formulation, experimentation, and critical reflection—to analyse physical phenomena mentioned in the Quran. Through this active learning strategy, scriptural verses regarding natural ecosystems, water cycles, and astronomical order are systematically mapped onto real-world scientific investigations. Students are encouraged to conduct small-scale scientific projects and laboratory activities that validate divine principles embedded within scripture, thereby bridging the traditional divide between theological faith and empirical reasoning. Operationally, this approach transforms the PAI classroom into a collaborative, inquiry-driven environment where scientific literacy and spiritual reflection simultaneously develop, allowing students to internalize religious values while building modern cognitive competencies.

The implementation of this integrative method is explicitly reflected in the instructional practices recounted by the lead PAI teacher. During an in-depth interview, the teacher stated:

"We no longer ask students to simply memorize verses about creation; instead, we guide them to investigate environmental sustainability by examining Surah Ar-Rum verse 41 through hands-on water quality testing around our school environment."

This statement directly highlights the pedagogical alignment with Surah Ar-Rum (30:41), which declares: *"Mischievous has appeared on land and sea because of the deed that the hands of men have earned, that Allah may give them a taste of some of their deeds, in order that they may turn back."* The researcher interprets this empirical finding as a significant shift from passive theological reception to active ecological consciousness. By grounding the Quranic warning regarding anthropogenic environmental degradation in concrete scientific testing, the teacher

effectively transforms an abstract moral commandment into a measurable, scientific reality, fostering both empirical analytical skills and profound spiritual accountability among high school students.

Complementing the teacher's perspective, the school principal emphasized the broader cognitive impact of combining Quranic study with project-based inquiry during an interview. The principal noted:

"Integrating scientific inquiry into PAI has energized our students; when studying plant biology, they do not just read textbook definitions but analyze Surah Al-An'am verse 99 while conducting botany experiments in our school greenhouse."

This operational approach explicitly draws upon Surah Al-An'am (6:99), which states: *"It is He who sends down rain from the sky, and with it We bring forth vegetation of all kinds; from it We bring forth green crops..."* The interpretation of this field evidence as a deliberate attempt to cultivate integrated epistemology among learners. By utilizing green-house experimentation to observe botanical growth alongside scriptural reflection, the school successfully dismantles the artificial barrier between sacred revelation and natural science. Students learn to view empirical biological processes not as secular facts isolated from religion, but as visible, physical manifestations of divine design and order.

Field observations conducted during PAI class sessions further substantiate the active implementation of inquiry-based learning. The researcher observed students working in small collaborative groups inside the school science laboratory, utilizing microscopes and digital soil sensors while analysing instructional worksheets that paired Quranic verses with ecological indicators. PAI teachers and science instructors acted as co-facilitators, prompting students to formulate scientific hypotheses regarding soil fertility and compare their empirical findings with Quranic descriptions of land revitalization. Students actively engaged in group discussions, recording data in lab notebooks while referencing relevant scriptural commentaries (*tafsir*). The researcher interprets these classroom observations as clear empirical evidence of a fully operationalized interdisciplinary pedagogy. The physical environment of the laboratory, combined with joint teacher facilitation, demonstrates that scientific inquiry is not merely an occasional supplementary activity, but a core instructional strategy embedded directly within the daily PAI curriculum to reinforce both analytical reasoning and spiritual conviction.

Restating the synthesized empirical data confirms that the Islamic Senior High School has successfully established an innovative pedagogical model connecting Quranic revelation with empirical science. The qualitative evidence gathered from teacher interviews, administrative insights, and structured classroom observations demonstrates that *kauniyah* verses are no longer taught through rote memorization or isolated textual lectures. Instead, scriptural study is systematically operationalized through student-led inquiry, greenhouse experimentation, environmental testing, and laboratory-based project activities. The integrated curriculum successfully pairs specific theological texts—such as verses on ecological balance and botanical growth—with practical scientific methodologies. This restatement underscores that teaching PAI through project-based scientific inquiry enhances student engagement,

deepens conceptual understanding of religious texts, and builds critical thinking capabilities. Ultimately, the school's instructional framework proves that religious education can be modernized without sacrificing orthodox theological foundations, turning traditional religious classes into dynamic arenas for interdisciplinary learning, scientific exploration, and holistic character formation.

A clear, consistent pattern emerges across the qualitative data collected from interviews, observations, and document analysis regarding pedagogical innovation. The overall data structure reveals a three-phase instructional sequence: textual introduction of the verse, empirical exploration through scientific inquiry, and reflective synthesis linking scientific findings back to Islamic ethics. First, teachers introduce relevant scriptural verses to establish a spiritual and conceptual foundation. Second, students transition to active empirical investigation—utilizing greenhouse facilities, laboratory equipment, or field environments to collect and analyse physical data. Third, instructional sessions conclude with collaborative reflections where students articulate how their scientific discoveries deepen their understanding of Quranic wisdom. This recurring pattern indicates that integrated learning at the school is not an ad-hoc occurrence, but a structured, institutionalized pedagogical strategy. By consistently repeating this three-phase learning loop, it successfully addresses the traditional dichotomy between science and religion, establishing a sustainable blueprint for interdisciplinary Islamic education.

Teacher Competency Gaps and Institutional Dualism in Curriculum Alignment

And teacher competency gaps and institutional dualism in curriculum alignment are the structural, epistemological, and administrative friction impeding the smooth integration of scientific values into Islamic Religious Education (PAI). Operationally, competency gaps refer to PAI educators' limited training in empirical scientific methodologies, digital tools, and interdisciplinary pedagogical design, leaving them hesitant to connect scriptural texts with contemporary science. Concurrently, institutional dualism represents the administrative tension arising from balancing two distinct educational frameworks: the national curriculum mandated by the Ministry of Education and Ministry of Religious Affairs, and the traditional pesantren curriculum emphasizing classical textual study. These overlapping demands create instructional overload, conflicting assessment priorities, and fragmented scheduling. Together, these dual constraints prevent educators from systematically operationalizing integrated lesson plans, transforming what should be a cohesive scientific-religious synthesis into an ad-hoc, highly fragmented classroom practice.

Table 1. Teacher Competency Gap and Institutional Dualism

Data	Indicator	Informant
"We struggle to design PAI lessons incorporating scientific inquiry because our formal background is purely in classical Islamic jurisprudence, without training in empirical methods."	Pedagogical Competency Gap	PAI Teacher

<i>"Teachers face severe scheduling conflicts and cognitive burnout trying to fulfill national curriculum targets while simultaneously meeting the rigorous traditional pesantren examination standards."</i>	Institutional Curriculum Dualism	Curriculum Coordinator
<i>"Our lesson plans remain divided because national assessment rubrics evaluate standardized cognitive skills, whereas pesantren evaluations focus on classical text memorization."</i>	Assessment & Alignment Friction	School Principal

The analysis of the interview matrix reveals a profound epistemological mismatch between teacher preparation and integrated curriculum ambitions. The first excerpt demonstrates that PAI educators suffer from a fundamental training deficit, as their academic background is rooted strictly in normative-textual Islamic studies. When expected to teach scientific inquiry, teachers experience instructional anxiety due to a lack of pedagogical content knowledge (*PCK*) bridging theology and empirical science. This competency gap is not merely an individual failure, but a systemic oversight in teacher professional development programs, which rarely offer interdisciplinary modules. Without targeted training, educators default to traditional lecture-based methods, bypassing scientific inquiry altogether. Consequently, the ambition to integrate scientific values remains a theoretical goal on paper rather than an active classroom practice, as teachers lack the practical confidence to facilitate empirical experiments or scientific discussions alongside scriptural analysis.

Furthermore, the data matrix highlights how institutional dualism creates severe administrative strain that stifles pedagogical innovation. As expressed by the curriculum coordinator and principal, the school operates under two competing educational authorities with divergent priorities. The national curriculum demands modern competencies, standardized problem-solving, and scientific literacy, whereas the internal pesantren framework prioritizes classical Arabic text mastery and rote memorization. This structural dualism forces teachers to navigate conflicting syllabi, duplicate lesson planning, and manage fragmented instructional schedules. Because assessment rubrics are unaligned, teachers are trapped in a dilemma: preparing students for national standardized testing or fulfilling traditional boarding school requirements. This administrative tension leads to cognitive overload and teacher burnout. Instead of synthesizing the two paradigms, educators are forced to split their instructional time, treating scientific PAI as an optional addition rather than an integrated core subject.

Classroom and administrative observations conducted strongly reinforce the interview findings regarding competency gaps and structural dualism. During observed PAI sessions, teachers predominantly utilized traditional text-based lectures, explicitly skipping the scientific inquiry activities outlined in their syllabus due to time constraints and unfamiliarity with lab equipment. In staff meetings, the researcher observed heated discussions among faculty regarding overlapping academic schedules between national exam preparation and pesantren evaluation weeks. Curriculum documents reviewed on-site showed two distinct, unintegrated lesson plan folders sitting side-by-side: one for the national *Kurikulum Merdeka* and

another for the internal *diniyah* curriculum. The researcher interprets these physical observations as empirical proof of structural fragmentation. The physical separation of curriculum folders and the observable hesitation of teachers to enter science laboratories confirm that institutional dualism and skill deficits actively block the practical realization of integrated learning.

Restating the synthesized research findings confirms that the integration of scientific values into PAI faces significant operational roadblocks. The empirical evidence gathered from teacher interviews, administrative records, matrix indicators, and direct observations demonstrates that integration is severely restricted by teacher competency deficits and dual institutional mandates. Educators lack specialized training in interdisciplinary science-religious pedagogy, while the school struggles to reconcile the competing demands of the national curriculum and the traditional system. This restatement clarifies that the primary barrier to curriculum modernization is not ideological resistance to science, but rather practical administrative friction, unaligned assessment frameworks, and inadequate professional support. Understanding these data points allows readers to recognize that successful curriculum integration requires more than policy mandates; it demands comprehensive teacher retraining, unified assessment rubrics, and structural alignment between national educational standards and traditional Islamic institutional goals.

A distinct, recurring pattern emerges across the qualitative data regarding the systemic barriers to curriculum alignment. The overall data structure illustrates a three-stage barrier cycle: epistemological separation during teacher training, structural duplication during lesson planning, and instructional fragmentation during classroom execution. First, teachers enter the institution with mono-disciplinary training, creating an initial skill gap. Second, when designing lessons, teachers encounter institutional dualism, resulting in duplicated administrative burdens as they attempt to satisfy both national and local requirements. Third, under the pressure of limited time and dual assessments, teachers abandon complex scientific-project methods and revert to safe, traditional lecture formats. This recurring pattern demonstrates that implementation challenges are systemic rather than accidental. Breaking this cycle requires institutional intervention: unifying national and pesantren learning objectives into a single integrated curriculum framework and providing continuous, interdisciplinary professional development for religious educators.

Discussion

The empirical finding demonstrating that contextualizing Quranic scientific verses through inquiry and project-based learning enhances student engagement strongly aligns with existing scholarship on integrated pedagogy. Previous research by (Andrews et al., 2020) and (Pan, 2020) similarly asserted that active, project-driven learning bridges abstract religious doctrines with real-world applications, thereby increasing student critical thinking. However, while earlier studies primarily examined soft skills or digital media ethics in isolation, our empirical findings extend this

discourse by demonstrating how hands-on scientific experimentation—such as greenhouse botany and environmental testing—directly operationalizes scriptural exegesis. This alignment proves that when *kauniyah* verses are paired with empirical inquiry, Islamic Religious Education (PAI) transitions from a passive memorization subject into an active analytical discipline. Theoretically, this finding reinforces integrative curriculum theory by confirming that faith-based values and empirical reasoning are epistemologically complementary when mediated through inquiry-based frameworks. Practically, it demonstrates that religious educators can successfully utilize existing science facilities, such as school laboratories, to elevate classroom interactivity, deepen theological understanding, and cultivate modern scientific literacy among high school students without compromising scriptural integrity.

Furthermore, this findings regarding teacher competency gaps and institutional dualism partially agree with, yet nuance, prior literature on Islamic educational administration. Existing scholarship by (Fandy, 2023) highlighted that religious educators often face pedagogical resistance when incorporating modern competencies due to traditional instructional habits. Our data confirm this competency deficit, showing that PAI teachers with mono-disciplinary backgrounds struggle to facilitate empirical laboratory methods. However, our study reveals a key divergence: the primary barrier is not ideological resistance to science, but rather structural strain caused by institutional dualism. PAI educators at the Islamic Senior High School are caught between the competing mandates of national curriculum standards and internal boarding school requirements. This administrative friction creates severe time constraints, cognitive overload, and fragmented lesson planning. Theoretically, this insight expands educational management literature by illustrating that policy-level curriculum integration fails unless structural alignment and institutional harmonization occur simultaneously. Practically, it underscores that school leaders must streamline administrative requirements rather than simply blaming teacher attitude for integration failures.

Analyzing both findings together reveals that successful pedagogical innovation is continually constrained by underlying administrative and training gaps. While the implementation of inquiry-based projects proves highly effective for student learning, its sustainability is repeatedly threatened by teacher skill deficits and conflicting assessment frameworks. This tension illustrates a clear structural dichotomy within contemporary Islamic secondary education: micro-level pedagogical willingness exists among teachers, but macro-level institutional support remains fragmented. The theoretical implication of this pattern is that integrated curriculum models must adopt a dual-level framework that simultaneously addresses epistemological synthesis in the classroom and structural alignment at the administrative level. Without resolving institutional dualism, innovative teaching strategies remain isolated, ad-hoc occurrences dependent on individual teacher initiative rather than systemic practice. Practically, this synthesis demands that educational policymakers, including the Ministry of Religious Affairs and foundation heads, design unified assessment rubrics that bridge national cognitive standards

with traditional religious mastery, allowing integrated project-based learning to become an officially recognized, sustainable instructional standard rather than an administrative burden.

From a theoretical perspective, this study advances the literature on Islamic educational reform by proposing an integrated "Epistemological-Administrative Framework" for secondary schools. Existing theoretical models frequently focus on the philosophical integration of revelation and science, ignoring the practical administrative mechanisms required for classroom implementation. Our research bridges this theoretical gap by demonstrating that epistemological integration cannot be sustained without administrative integration. By introducing institutional dualism as a critical variable, this study enriches holistic curriculum theory, proving that structural harmony is a prerequisite for sustained pedagogical innovation. Furthermore, these theoretical insights challenge the conventional dichotomy between sacred and secular knowledge, offering a conceptual blueprint where empirical science functions as a pedagogical tool to deepen spiritual conviction. Consequently, this study contributes to curriculum management theory by shifting the scholarly debate from purely philosophical justifications of integrated Islamic education toward actionable, structural, and administrative frameworks necessary for real-world institutional transformation across Islamic primary and secondary institutions globally.

In practical implications, the findings provide actionable guidelines for curriculum developers, school administrators, and teacher training institutions. First, school principals and foundation leaders must immediately harmonize the dual curriculum by merging national learning outcomes with pesantren targets into a single, unified instructional syllabus, thereby eliminating duplicated lesson planning and reducing teacher burnout. Second, teacher professional development programs must be radically restructured; training departments should provide interdisciplinary workshops that equip PAI educators with practical scientific inquiry skills, laboratory management, and collaborative team-teaching techniques alongside science faculty. Third, policymakers at the Ministry of Education and Ministry of Religious Affairs should establish standardized rubrics that explicitly evaluate both scientific literacy and religious character formation in integrated project-based assignments. By implementing these concrete practical steps, educational institutions can systematically dismantle administrative bottlenecks, empower religious educators with contemporary teaching competencies, and ensure that integrated Islamic education successfully prepares students to navigate the complex scientific, technological, and ethical challenges of the modern world.

Conclusion

This study concludes that integrating scientific values into Islamic Religious Education (PAI) through inquiry and project-based learning significantly enhances student analytical reasoning and spiritual reflection, proving that faith and empirical science are epistemologically complementary. The primary lesson learned is that pedagogical innovation thrives when scriptural exegesis is paired

with hands-on experimentation, yet its sustainability is heavily constrained by teacher competency gaps and institutional dualism between national standards and traditional pesantren mandates. The scholarly strength and core contribution of this paper lie in establishing a holistic "Epistemological-Administrative Framework," demonstrating that classroom pedagogical synthesis must be supported by structural administrative harmony and unified assessment systems. Nevertheless, this research is limited by its single-site qualitative case study design, which restricts the direct generalizability of its empirical findings to broader educational settings. Future research should expand this inquiry through multi-site mixed-methods studies across diverse Islamic secondary institutions, evaluating long-term quantitative impacts on student scientific literacy and developing standardized interdisciplinary professional development modules for religious educators worldwide.

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