

Integrating Islam and science in curriculum and instruction: A case study at Al-Falah pesantren, Pamekasan

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Abstract: This study examines how Islam–science integration is formulated and enacted in the curriculum and instructional practices of Al-Falah Pesantren, Pamekasan. This study employed a qualitative single-case study design. Data were collected through semi-structured interviews with 15 informants, five observations of classroom and academic activities, and analysis of institutional documents, from March to May 2026. The findings show that integration operates through connected educational layers: a *tawhid*-based epistemological vision, a hybrid curriculum, classroom and laboratory learning, *Bahtsul Masail*, digital leadership, and institutional support. Integration became most visible when classical Islamic texts, Qur’anic reflection, empirical observation, scientific reasoning, and ethical judgment were jointly used to address authentic issues such as environmental care, laboratory discipline, health, digital transactions, and social responsibility. However, the implementation remained uneven across subjects and educational levels, particularly in teacher collaboration, interdisciplinary planning, integrative assessment, and institutional evaluation. The study’s conclusion is that the coexistence of religious and science subjects does not automatically result in substantive integration unless the institutional vision is translated into curriculum content, teaching strategies, learning activities, and assessable competencies.

Keywords: Instructional practices, Islam–science integration, pesantren curriculum

Abstrak: Penelitian ini mengkaji bagaimana integrasi Islam–sains dirumuskan dan dilaksanakan dalam kurikulum serta praktik pembelajaran di Pesantren Al-Falah, Pamekasan. Studi ini menggunakan desain studi kasus tunggal kualitatif. Data dikumpulkan melalui wawancara semi-terstruktur terhadap 15 informan, lima observasi kegiatan kelas dan akademik, serta analisis dokumen kelembagaan, dari Maret hingga Mei 2026. Temuan menunjukkan bahwa integrasi berlangsung melalui beberapa lapisan yang saling terhubung, yaitu visi epistemologis berbasis tauhid, kurikulum hibrida, pembelajaran kelas dan laboratorium, Bahtsul Masail, kepemimpinan digital, dan dukungan kelembagaan. Integrasi tampak paling kuat ketika teks keislaman klasik, refleksi Qur’ani, observasi empiris, penalaran ilmiah, dan pertimbangan etis digunakan bersama untuk membahas persoalan autentik seperti lingkungan, kedisiplinan laboratorium, kesehatan, transaksi digital, dan tanggung jawab sosial. Namun, implementasinya belum merata pada seluruh mata pelajaran dan jenjang, terutama dalam kolaborasi guru, perencanaan lintas disiplin, asesmen integratif, dan evaluasi kelembagaan. Penelitian ini menyimpulkan bahwa keberadaan mata pelajaran agama dan sains secara berdampingan belum otomatis menghasilkan integrasi substantif tanpa penerjemahan visi kelembagaan ke dalam isi kurikulum, strategi pembelajaran, aktivitas belajar, dan kompetensi yang dapat diukur.

Kata kunci: Praktik pembelajaran, integrasi Islam–sains, kurikulum pesantren

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INTRODUCTION

One of the most influential Islamic educational institutions in Indonesia has long been the pesantren. The curriculum has traditionally focused on passing on religious knowledge through learning the Qur’an, Arabic grammar, classical Islamic texts, jurisprudence, theology and moral formation. This tradition has made the pesantren a resilient space for spiritual discipline, religious authority and character education. But the historical

segregation of religious sciences from general sciences has also resulted in a curriculum pattern, where Islamic knowledge and modern scientific knowledge are often delivered through different institutional routes. Consequently, students may learn religious texts and general subjects but are not necessarily led to relate the two forms of knowledge in a meaningful learning experience (Abdullah, 2006; Mokodompit et al., 2025; Ramadina et al., 2025).

Recent developments indicate that many pesantren are no longer content with a curriculum that only maintains classical religious learning. The digital transformation, scientific literacy, social change and the push for twenty-first century competencies have encouraged pesantren to revise their curriculum without abandoning their religious identity. Modern pesantren increasingly combine kitab kuning, Qur'anic memorization, formal schooling, science subjects, digital administration and vocational or life-skills programmes. This shift indicates that the pesantren curriculum is moving away from a single religious orientation to a more hybrid model of Islamic education. The main problem is not whether pesantren should accept science but how scientific knowledge can be integrated without undermining the ethical, spiritual, and intellectual foundations of pesantren education (Huda et al., 2025; Musaddad, 2025; Zuhri & Syamsi, 2023).

Studies on Islam and science in education usually come from two directions. The first direction considers the integration of science into the curriculum of Islamic education such as providing science courses, laboratories, digital learning, and project-based learning in Islamic schools and pesantren. The second direction considers the integration of Islamic values into science teaching, e.g. relating scientific phenomena to Qur'anic reflection, moral responsibility and religious significance. Both approaches are important because integration should not just mean putting religious and scientific subjects side by side. This should be a deliberate pedagogical process that integrates dialogue between religious texts, empirical investigation, standards of evidence, and ethical reflection in curriculum planning, classroom instruction, and assessment (Latjompoh et al., 2025; Riwanda et al., 2026).

Previous studies have greatly contributed to the understanding of pesantren adaptation, integrated curriculum, and science learning in Islamic educational settings. In some studies, it is explained how pesantren can mix the traditional and modern curriculum to fulfill the needs of education in this modern era. Others show that argumentation-based science learning and dialogue between religion and science can diminish the perceived conflict between faith and scientific explanation. Research into madrasah assessment also points to the importance of literacy-based integration, which connects reading, numeracy, science and socio-cultural understanding with Islamic values. However, the majority of existing research is dedicated to institutional reform, curriculum structure, or specific classroom strategies. Rarely do they trace the movement of an epistemological vision of Islam–science integration from institutional objectives to curriculum design, teacher interpretation, instructional practice, student engagement, and assessment in a single pesantren ecosystem (Hakim, 2023; Ramadina et al., 2025; Taufiq & Suryo, 2024; Zarkasi et al., 2025).

Preliminary observations at Al-Falah Pesantren in Dempoh Barat, Pamekasan, show that this institution is a relevant case to study such a process. Al-Falah continues the practice of memorizing the Qur'an, learning classical Islamic texts, religious habituation, and the

culture of residential pesantren. It also offers formal education, science subjects, laboratory activities, and digital administration. This coexistence creates an environment that is conducive to the observation of whether Islam and science are not only parallel but also connected through curriculum and teaching. In addition, preliminary findings indicate that integration is present in a variety of practices, including the discussion of Islamic commercial jurisprudence in relation to contemporary economic issues, scientific laboratory activities, the utilization of digital Islamic reference sources, and *Bahtsul Masail* as a platform for resolving real-world social and religious issues.

Today, it is desired that pesantren education do not differentiate between religious learning and science. The curriculum of a contemporary pesantren should equip students with the ability to read classical Islamic texts, comprehend empirical phenomena, employ ethical decision-making in response to real-world challenges, and employ reasoned argumentation. To this extent, integration encompasses more than the mere inclusion of contemporary subjects in the curriculum. This necessitates specific learning objectives, subject matter from multiple disciplines, teacher collaboration, substantive learning activities, and assessment instruments that evaluate students' capacity to incorporate religious comprehension with scientific reasoning. Without these components, the integration of Islam and science may be merely a slogan and not a practical curriculum (Fogarty & Pete, 2009; Tran & O'Connor, 2024; Yin, 2017).

This present study based on this gap examines the integration of Islam and science in the curriculum and instruction of Al-Falah Pesantren, Pamekasan. The research questions are: How is integration expressed in the aims, structure, and content of the Al-Falah curriculum? How is it enacted in teaching strategies, learning activities, resources, interaction, and assessment? What pedagogical and institutional conditions support or constrain the implementation of integration? Conceptually, this study draws on Abdullah's integration-interconnection framework to investigate the relationship between textual, empirical, and ethical knowledge; Fogarty's integrated curriculum model for investigating interdisciplinary curriculum links; and Bahm's conception of science to make sense of scientific reasoning in learning activities. The study aims to develop an empirically based model of curriculum and instruction development in pesantren that integrates spiritual depth, scientific literacy, ethical responsibility, and contextual problem-solving.

METHOD

This research employed a qualitative method with a single-case study design to analyze the formulation and implementation of Islam–science integration in the curriculum and instructional practices of Al-Falah Pesantren, Dempoh Barat, Pamekasan. The study was conducted from March to May 2026. The study was a case study design because the study was concerned with a bounded educational setting where institutional vision, curriculum documents, teaching practices, student learning activities and assessment could be investigated in their natural context. The design allowed the researchers to follow the flow of integration from policy and curriculum to classroom instruction and academic practices (Creswell & Poth, 2017; Mtisi, 2022; Yin, 2017).

Al-Falah Pesantren was chosen deliberately due to its integration of residential pesantren traditions with formal schooling and digital administration. The institution runs madrasah units for formal education and introduces science, technology and administrative

digitalization along with Qur'anic memorization, learning of classical Islamic texts, religious habituation and boarding-based character formation. This fusion made Al-Falah a rich case for studying the ways in which religious and scientific knowledge were linked, divided, or negotiated in practice. The units of analysis were curriculum policy, lesson planning, teaching practice, student learning activities, assessment instruments, academic forums, administrative support and institutional culture (Bouncken et al., 2026; Mtisi, 2022; Yin, 2017).

Fifteen informants were chosen by means of purposive sampling from those who were directly involved in designing, managing, implementing or undergoing Islam–science integration. They were composed of one pesantren leader, four residential and administrative staff from male and female units, four senior *santri* to represent male and female student communities, three vice principals for curriculum from the Madrasah Ibtidaiyah, Madrasah Tsanawiyah and Madrasah Aliyah levels, and three principals from the same educational units. The age of pesantren leader was 51 years. The age of residential and administrative staff was 19–27 years. The age of senior *santri* was 15–18 years. The age of vice principals for curriculum was 27–35 years. The age of madrasah principals was 30–42 years. The informants were from institutional leadership, residential and administrative management, curriculum planning and instructional implementation and student learning experiences. Participants were required to possess direct knowledge of the curriculum, instruction, academic culture, and institutional management of Al-Falah Pesantren, justifying the use of purposive sampling (Bouncken et al., 2026; Hennink & Kaiser, 2022; Palinkas et al., 2015).

Table 1. Demographic profile of research informants

Informant	N	Gender	Age range	Role in the study
Pesantren leader	1	Male	51 years	Explaining institutional vision, religious authority, and strategic policy direction
Residential and administrative staff	4	Male and female	19–27 years	Explaining boarding management, administration, religious habituation, student discipline, and academic support
Senior <i>santri</i>	4	Male and female	15–18 years	Describing learning experiences, classroom practices, laboratory activities, and participation in academic forums
Vice principals for curriculum	3	Male and female	27–35 years	Explaining curriculum structure, lesson planning, integration across subjects, and learning supervision
Madrasah principals	3	Male and female	30–42 years	Explaining school-level policy, institutional implementation, teacher coordination, and academic evaluation
Total	15	Male and female	15–51 years	Representing leadership, management, curriculum, instruction, administration, and student experience

Data were collected through semi-structured interviews, observation and document analysis. Each informant took part in one interview which lasted approximately 90 minutes. The interviews covered curriculum orientation, classroom implementation, science learning, *Bahtsul Masail*, digitalization and institutional management and support for

integration. Interview questions included: “How does Al-Falah Pesantren define the relation between Islamic knowledge and science in its curriculum?” “How do teachers relate religious texts, empirical knowledge, and ethical reflection in classroom teaching?” “What institutional factors support or constrain the implementation of Islam–science integration?” The questions were developed based on the research questions, guided by Abdullah’s integration–interconnection framework, Fogarty’s integrated curriculum model, and previous studies on curriculum enactment and Islam–science integration (Abdullah, 2006; Fogarty & Pete, 2009; Riwanda et al., 2026; Tran & O’Connor, 2024).

The researchers also did five observations of classroom and academic activities, each about 30 minutes long. Observations focused on teacher–student interaction, religious and scientific references, laboratory activities, student participation, academic discussion, and types of assessment. Document analysis was applied to curriculum structures, institutional policies, lesson plans, teaching materials, academic schedules, assessment instruments and records concerning technology-supported educational programmes. Institutional claims, teacher practices, student experiences, administrative evidence and documentary materials were compared across the three data sources. Using a combination of interviews, observations and documents, the researchers were able to identify alignment and tension between the intended curriculum and the enacted curriculum (Bouncken et al., 2026; Hennink & Kaiser, 2022; Palinkas et al., 2015).

The researchers were the main tools for data collection and interpretation, supported by interview guides, observation sheets, field notes and a document-analysis matrix. With the consent of the participants, the interviews were recorded and transcribed verbatim in the language of the interview. Each transcript was checked twice against the original recording to correct omissions, to clarify unclear expressions and to verify accuracy. Personal names and institutional positions were replaced by participant codes prior to analysis. The pesantren leader was coded as PL-1, residential and administrative staff as ADM-1 to ADM-4, senior *santri* as SAN-1 to SAN-4, vice principals for curriculum as CUR-1 to CUR-3 and madrasah principals as PRN-1 to PRN-3. Participation was voluntary and ethical approval was obtained from Al-Falah Pesantren, reference number 075/S.Ket./PP.AF.DB/V/2026 (McKim, 2023; Schlunegger et al., 2024; Taquette & Borges da Matta Souza, 2022).

Data analysis began during the fieldwork and continued after data collection was completed. Interview transcripts, observation notes and documents were repeatedly read and coded with a combination of inductive and deductive approaches. The deductive codes were based on the research questions and the theoretical framework, i.e. epistemological orientation, curriculum design, instructional enactment, student experience, institutional support and assessment. Inductive codes were developed from patterns emerging from accounts of participants and observed practice. Codes were then compared across data sources, categorised and developed into broader themes. The last themes were linking epistemological vision, curriculum architecture, classroom and laboratory instruction, *Bahtsul Masail*, digital leadership, administrative support, and institutional conditions. To establish credibility, source triangulation, method triangulation, member checking, peer debriefing, negative-case analysis and an audit trail of analytical decisions were used (Braun & Clarke, 2021; Miles et al., 2013).

RESULTS AND DISCUSSION

Epistemological vision and curriculum architecture

The findings were supported by interview excerpts from five categories of informants: the pesantren leader, residential and administrative staff, senior *santri*, vice principals for curriculum, and madrasah principals. These excerpts illustrate how Islam–science integration was understood, planned, enacted, and evaluated across different institutional positions at Al-Falah Pesantren.

Pesantren leader Informants:

“Religious knowledge and science essentially come from the same source, namely Allah. There is no separation between the knowledge taught through revelation and the knowledge discovered through observation of nature. In this pesantren, we understand science as a way of reading the *ayat kauniyah*, while religious knowledge guides us in reading the *ayat qauliyah*. Both must move together” (Pesantren leader, male, 51 years old/PL-1).

“The path to our vision of generating santri who are devout, knowledgeable, committed to virtuous action, and faithful is through integration. We are not interested in santri who merely memorize the Qur'an and classical texts; they must also be able to reason analytically and solve contemporary issues.” (PL-1).

“We maintain our commitment to tradition. Classical Islamic texts and the memorization of the Qur'an continue to serve as the foundation of pesantren education. Science and technology are incorporated as complementary educational components. The schedule is structured to ensure that formal and science lessons are conducted in the morning, while classical text study and memorization are conducted in the afternoon and evening.” (PL-1).

“We support digitalization as long as it does not weaken pesantren values. Technology is a tool, not the goal. The main challenge is how to preserve face-to-face, familial pesantren culture amid digital currents that tend to make people more individualistic” (PL-1).

Residential and administrative staff Informants:

“I see religious knowledge and science as one complete unity. In pesantren, we are taught that seeking knowledge is obligatory, whether it is religious knowledge or knowledge that benefits worldly life. Science does not contradict Islam; it strengthens faith when we see the order of nature” (Residential and administrative staff, male and female, 19–27 years old/ADM-1).

“In managing administration and the dormitory, we use modern management principles, which are part of scientific knowledge, but we frame them with Islamic values such as honesty, trustworthiness, and responsibility” (ADM-1).

“In daily dormitory life, we see that worship habituation and discipline are connected to scientific principles, for example in matters of health and cleanliness. So, integration is already present in everyday practice” (ADM-3).

"In the female dormitory, we organize waste recycling activities. This teaches science about waste management and also Islamic values about cleanliness and avoiding excess" (ADM-3).

"We already use a pesantren management information system to manage student data, finances, and other administrative matters. It helps make administration faster, more efficient, and more orderly" (ADM-1).

Senior *santri* informants:

"As a *santri*, I feel that religious subjects and general subjects cannot be separated. For example, when I learned physics about gravity, I was reminded of how great Allah's power is in regulating everything" (Senior *santri*, male and female, 15–18 years old/SAN-1).

"I feel the balance. I can memorize the Qur'an and also learn physics. Both have their own challenges, but both are important for us" (SAN-2).

"I once joined a lesson about eclipses. We learned the scientific causes of eclipses, then performed the eclipse prayer and listened to a sermon about the greatness of Allah. It was very memorable" (SAN-1).

"I really like laboratory practice. We learn many things, such as observing plant cells or conducting chemical reactions. We are also taught to be careful, orderly, and responsible" (SAN-2).

"I feel more motivated to study science because I know that learning science is also part of worship" (SAN-4).

Vice principals for curriculum informants:

"In curriculum planning, we see integration as a necessity. We can no longer teach religion separately from the realities of life that are shaped by science and technology. Students need to understand that Islam is *rahmatan lil 'alamin*, and science is one of the ways to realize it" (Vice principals for curriculum, male and female, 27–35 years old /CUR-1).

"Our curriculum structure combines the Ministry of Religious Affairs curriculum, the national education curriculum, and the pesantren's own curriculum. The national curriculum regulates general subjects, including science, while the pesantren curriculum regulates classical text study, Qur'anic memorization, and religious habituation" (CUR-1).

"We design the curriculum in an integrated way. Every teacher of general subjects is expected to find Qur'anic verses or hadith relevant to the material being taught. For example, biology teachers may connect lessons with verses about creation, and physics teachers may connect lessons with verses about eclipses" (CUR-1).

"We also hold regular meetings between religious teachers and general-subject teachers to share materials and find points of connection. We call this *team teaching*" (CUR-2).

“We often use problem-based learning. For example, students are given a problem about river pollution. They are asked to find scientific solutions while also examining Islamic views on environmental protection” (CUR-2).

Table 2. Summary of findings based on data sources

Theme	Interview evidence	Observation/document evidence	Analytical meaning
Curriculum integration	PL-1, CUR-1, PRN-1, and SAN-1 described knowledge as connected through tauhid, curriculum planning, and daily learning.	Curriculum documents showed the coexistence of Qur’anic memorization, <i>kitab kuning</i> , formal schooling, science subjects, and pesantren habituation.	Integration was institutionally articulated, but its depth depended on how teachers translated the vision into learning design.
Instructional enactment	CUR-1, CUR-2, PRN-3, and SAN-3 described examples of water purification, environmental projects, laboratory work, and food-related discussions.	Observations recorded teacher-student interaction, science activities, academic discussion, and the use of religious and scientific references.	Integration became visible when texts, empirical reasoning, and ethical reflection were used together in concrete learning situations.
<i>Bahtsul Masail</i>	PL-1, CUR-2, SAN-2, and SAN-3 explained the role of collective inquiry, classical texts, rational argument, and factual information.	The forum was documented as a regular academic activity involving teachers, kiai, and senior <i>santri</i> .	<i>Bahtsul Masail</i> functioned as deliberative pedagogy that trained contextual reasoning and ethical judgment.
Institutional conditions	ADM-1, ADM-2, CUR-1, PRN-3, and PL-1 described SIMP, Maktabah Syamilah, digital reports, teacher capacity, and infrastructure challenges.	Documents showed technology-supported administration, digital communication, and assessment records.	Digitalization and leadership supported integration, but teacher competence, time, facilities, and assessment remained limiting factors.

Madrasah principals informants:

“As a madrasah principal, I see that this understanding must become the basis for all teachers. We regularly hold coordination meetings to align perceptions on how to teach science without losing Islamic values” (Madrasah principals, male and female, 30–42 years old/PRN-1).

“At the MTs level, we try to bridge the national curriculum, which requires scientific mastery, with the pesantren curriculum, which emphasizes classical Islamic texts. We do not separate the two; rather, we look for ways for them to strengthen each other” (PRN-2).

“The relationship is complementary. Religious teachers provide the value foundation, while general-subject teachers provide empirical understanding” (PRN-3).

“In laboratory activities, the values emphasized are honesty in recording data, accuracy, cooperation, and responsibility. We also begin laboratory practice with prayer” (PRN-3).

“For religious subjects, we conduct memorization tests and classical text examinations. For science, we conduct written tests and laboratory practice. At the MA level, we also assign projects in which students examine a problem and prepare reports that integrate scientific and Islamic ethical aspects” (PRN-3).

The excerpts imply that integration at Al-Falah was not simply seen as the co-existence of religious and scientific subjects. Informants described integration as a movement back and forth between theological meaning, curriculum planning, classroom practice, problem solving, and institutional management. The interview data also indicated that integration was still patchy. Some practices were already visible such as relating fiqh to everyday problems or using scientific examples in religious learning. Other aspects were still evolving, in particular collaborative planning and integrative assessment.

Table 2 shows that the three research questions were answered by overlapping evidence, rather than by separate streams of data. Interviews provided insight into how the actors understood integration, observations showed how integration was manifested in learning and academic routines and documents helped to verify whether the claims made by the institution were supported by the curriculum and administrative records.

Curriculum integration: From institutional vision to learning design

Institutionally, Al-Falah situated the integration of Islam and science within a *tawhid*-based understanding of knowledge. The pesantren leader did not speak of science as an external appendage to religious education, but as a way of reading the order of creation. This was the position of the curriculum leaders who viewed the division between religious and general knowledge as a classification in the classroom rather than an ontological division. In the terminology of Abdullah, Al-Falah was trying to position textual, empirical and ethical reasoning into a more dialogic relation, although this was more evident in some learning areas than others (Abdullah, 2006; Riwanda et al., 2026; Zarkasi et al., 2025).

This epistemological stance was translated into a hybrid curriculum. The curriculum included memorization of the Qur'an, classical Islamic texts, religious habituation, formal madrasah subjects, science and some technology-supported activities. CUR-1 stated that the curriculum was derived from the curriculum of the Ministry of Religious Affairs, national education curriculum and curriculum of the pesantren itself. This helped Al-Falah to keep up the salaf tradition and to answer the need for scientific literacy. But the data also suggest that curricular coexistence was not a guarantee of integration. The success of integration

depended on the intentional construction of the bridges of concepts, values, and learning tasks made by the teacher (Abidin, 2025; Cathrin et al., 2021; Musaddad, 2025).

Teachers who connected Islamic knowledge to subjects students would probably find in their everyday lives gave the most concrete examples of intended integration. One curriculum coordinator explained that water was a common theme: In science students learnt about water cycles and purification and in fiqh students learnt about purification and the legal requirement of clean water. Other projects included planting vegetables, recycling waste, talking about eclipses and environmental fiqh. Integrasi menjadi kurang abstrak berkat contoh-contoh ini, yang memungkinkan siswa untuk mengamati konvergensi pengamatan empiris, tindakan praktis, dan pemahaman keagamaan dalam satu pengalaman belajar. Hal ini memperkuat gagasan bahwa integrasi paling efektif ketika berakar pada masalah yang bermakna, daripada ketika mata pelajaran disampaikan secara paralel (Fogarty & Pete, 2009; Hasni et al., 2012).

However, there were some tensions in the curriculum design. Not all teachers were equally ready to combine Islam and science. CUR-1 said some taught their subjects separately. CUR-2 referred to the density of the national curriculum and PRN-1 to the limitations of science laboratory facilities. Such limitations are important, for they demonstrate that the integration of Islam and science is not a question of theological consensus. It also takes time, resources, teacher capacity and coordination. Prior research on pesantren modernization also notes that the integration of the curriculum often relies on the preparedness of the institution and the capacity of teachers to execute the curriculum in tangible classroom practice (Rizki & Rijal, 2026; Uwaisah, 2026).

Instructional enactment: Classroom, laboratory, and *Bahtsul Masail* practices

In classroom practice, integration occurred when teachers linked religious texts and empirical phenomena without reducing one to the other. The teacher used examples of creation, ecology, water cycle and astronomical events to open discussion on ayat kauniyah in science learning. The *santri* were not simply given a religious message attached to scientific content, they were invited to observe, explain and reflect. For some students, such as SAN-1 and SAN-4, science offered a site for religious reflection. SAN-1 learned about gravity and SAN-4 talked about ecosystems. This finding was in line with the previous findings that the Islam-science learning becomes meaningful when empirical reasoning and religious meaning are allowed to interact carefully (Husni et al., 2025; Riwanda et al., 2026; Zuhri & Syamsi, 2023).

In laboratory activities, this integration took on a practical dimension. The informants described the science practicum as a place where students learned to be accurate, orderly, cooperative, honest with recording data, and responsible for utilizing the materials. SAN-2 mentioned activities including looking at plant cells and conducting chemical reactions. PRN-3 highlighted that the laboratory work started with prayer and included values such as honesty and teamwork. From Bahm's point of view, these activities consisted of some parts of scientific practice: problems, methods, observation, conclusion and consequences. The limitation is these elements have not been fully converted into explicit indicators of assessment (Bahm, 1993; Sayyi, et al., 2025; Zarkasi et al., 2025).

Another aspect of the visible character of integration was the problem-based learning. CUR-2 described an activity in which students discussed river pollution, looked for scientific

solutions, and researched Islamic teachings about protecting the environment. PRN-1 described a mini-garden project in which students learned about plant care and reflected on provision and gratitude. SAN-3 discussed the halal and haram in food, looking at chemical substances and Islamic rules. These examples suggest that integration occurred when teachers began with a concrete problem, opened the door to empirical analysis, and then asked students to reflect on ethical and religious implications. This practice is in line with the research that value-based science instruction can support problem-solving and ethical awareness (Chan & Erduran, 2023; Mahanis & Witono, 2025).

Bahtsul Masail was a prime example of deliberative integration. The forum was regularly held and involved kiai, teachers and senior *santri*. PL-1 said it was a tradition for talking about important issues. SAN-2 said that taking part made him feel like a “small scholar” who had to defend an opinion with evidence. Typically the forum began with a real problem, followed by factual clarification, looking up classical sources, comparing arguments, and choosing the most defensible conclusion. The sequence brought *Bahtsul Masail* close to problem-based and deliberative pedagogy because knowledge was used to solve real situations through evidence, dialogue and guided reasoning (Azizah et al., 2025; Hudri et al., 2023; Musaddad, 2025).

The interdisciplinary nature of *Bahtsul Masail* is also reflected in the topics discussed. Informants cited Islamic economics, medical technology, vaccination, climate change, ethics of social media, environmental responsibility and cryptocurrency. CUR-2 explained that the *santri* used classical texts as the main source of legal reasoning, but also used reason and factual data to analyze the problem. This oscillation between naql, aql, and empirical data suggests that *Bahtsul Masail* was not just a preservation of classical authority, but rather a training of students to think about how classical reasoning could answer contemporary questions. Thus, the forum served as a link between textual knowledge, social knowledge and scientific information (Ibtihajuddin et al., 2025; Musaddad, 2025; Susandi et al., 2025).

Classroom practice and *Bahtsul Masail* also reveal unresolved issues. Sometimes integration is more a function of individual teacher initiative than collaborative learning design. The use of verses, promising ethical reflections, and scientific explanations are not always accompanied by rubrics assessing students' ability to synthesize these domains. CUR-2 stated that schools have begun developing HOTS questions that require scientific and Islamic analysis. A project report on scientific and Islamic ethics was referenced in PRN-3. That is a commendable beginning. However, the assessment system requires more precise indicators of ethical reasoning, evidence use, and contextual assessment to ensure that integration is evaluated in all activities, rather than just specific ones (Savana & Sutyono, 2025; Zarkasi et al., 2025).

Institutional conditions: Digital leadership, collaboration, and assessment gaps

Institutional leadership exerted a significant influence on the integration process. To maintain the pesantren's religious orientation, PL-1 clarified that his responsibility is to provide guidance and protection. CUR-2 and PRN-1 also stated that the kiai's support made other actors more likely to follow the integrative direction. In this context, leadership was demonstrated through moral authority, coordination of meetings, and daily example, in addition to formal policy. The discovery substantiates the notion that the transformation of pesantren is more easily maintained when the innovation is endorsed by the institution's

own value system, rather than being compelled by an external agenda (Abidin, 2025; Hamdanah et al., 2025).

The main support for integration was administration, communication and access to references through digitalisation. ADM-1 said that they used a pesantren management information system for student data, finance, and administration. ADM-3 said they communicated with parents through WhatsApp groups and the Sekolahku application, while PRN-3 said they used digital systems for scheduling, grading, and creating report cards. These systems did not directly revolutionize each and every classroom but they did help to make the institution more orderly and improve the flow of information. Research on the digitalization of pesantren also shows that administrative transformation as a prerequisite to instructional innovation at a deeper level (Abidin, 2025; Z. Abidin, 2020; Rohana et al., 2026).

Digital resources were also a part of academic practice. CUR-1 said that Maktabah Syamilah, a digital library with thousands of classical Islamic texts, was introduced to teachers and *santri*. CUR-3 added that this application helped the *santri* to get reference during *Bahtsul Masail* and assignments without bringing many printed books. SAN-1 also enjoyed the application because it allowed for fast searching and note taking. These accounts demonstrate that digitalization has not necessarily weakened the kitab tradition. Rather, it changed the pace, scope and manner of accessing classical sources as long as teacher supervision and source verification were maintained (Fauzi et al., 2024; Riwanda et al., 2026).

Its main constraints were human resources, time, facilities and coordination. CUR-1 noted the variation in teacher competence to integrate Islam and science. CUR-2 pointed to the limited time available, due to the density of the national curriculum. PRN-2 observed limited laboratory facilities and scheduling conflicts between pesantren and madrasah activities. ADM-3 said it could take time to get coordination across units. These limitations are not mere technicalities; they are the determining factors in the implementation of the integrative vision on a daily basis. Additionally, they provide an explanation for the fact that integration was prominently featured in certain activities, while it was less prominent in routine assessment and cross-subject planning (Nuraini et al., 2025; Zahra, 2025).

Assessment was identified as a critical area that necessitates enhancement. The institution implemented a variety of assessment methods, including written exams, oral examinations, memorization assessments, classical-text evaluations, practicums, assignments, and character evaluations. This variety of methodologies suggests that the evaluation addressed cognitive, practical, and moral domains. However, the data suggest that integrated assessment practices were still in the process of being developed. CUR-1 recognized the necessity of a more comprehensive assessment instrument, PRN-3 emphasized the significance of training teachers to develop integrated questions, and ADM-2 emphasized the necessity of supplementary time and resources to facilitate a more in-depth evaluation. The primary obstacle is not the absence of assessment, but rather the absence of a consistent instrument to quantify the extent to which students synthesize religious comprehension, scientific reasoning, and ethical responsibility (Savana & Sutiyono, 2025; Zarkasi et al., 2025).

Finally, Al-Falah is better understood as a pesantren in the process of multidisciplinary integration, instead of an institution that has achieved it. Its strength lies

in coherent religious vision; hybrid curriculum; selected classroom practices; *Bahtsul Masail*; digital support; and strong leadership. Its weaknesses are uneven readiness of teachers, scarcity of facilities, congested schedule and lack of fully developed integrative assessment. The case thus suggests that meaningful Islam-science integration requires more than a label for a curriculum. It requires collaborative planning, teacher training, authentic tasks, valid assessment and institutional evaluation that consistently link the intended curriculum to the actual student experience (Rohana et al., 2026; Tran & O'Connor, 2024; Zarkasi et al., 2025).

Table 3. Summary of Islam–science integration at Al-Falah pesantren

Analytical Subsection	Analytical Focus	Main Findings	Implications
Epistemological vision and curriculum architecture	The formulation of integration within institutional vision, curriculum structure, and content	A unified knowledge paradigm has been institutionally articulated, but integration remains uneven across subjects and educational levels.	Institutional vision, curriculum organization, teacher collaboration, and assessment need to be more systematically aligned.
Instructional enactment	Teaching strategies, learning activities, laboratory practices, and assessment	Integration is enacted through dialogue among religious texts, empirical phenomena, scientific practice, and ethical values.	Collaborative lesson planning and specific instruments for assessing integrative learning outcomes are required.
<i>Bahtsul Masail</i>	Deliberative, contextual, and axiological pedagogy	Classical texts are brought into dialogue with socioeconomic problems and digital transactions through collective reasoning	Interdisciplinary inquiry procedures and argumentation-quality rubrics should be developed
Leadership and digitalization	Institutional conditions supporting and constraining integration	Kiai leadership, digital technology, and the hybrid educational system strengthen transformation, but teacher capacity remains uneven	Professional development, digital governance, collaborative planning, and continuous evaluation should be strengthened

The four themes suggest that the integration of science and Islam at Al-Falah Pesantren is not limited to a single program. It is a product of the convergence of deliberative traditions, leadership, digital transformation, classroom practice, curriculum design, and epistemological commitments. The most comprehensive integration involved

the combination of empirical reasoning, ethical reflection, and religious texts to address genuine issues. Nevertheless, the long-term sustainability of the approach is contingent upon the enhancement of teacher competence, the implementation of a more systematic institutional review process, the implementation of valid integrative assessment, and the implementation of routine interdisciplinary planning..

The synthesis in Table 3 suggests that the Islam-science integration at Al-Falah is operationalised via linked layers, rather than via one programme. The curriculum provides structure for the vision, classroom and laboratory activities are the primary learning space, *Bahtsul Masail* develops deliberative reasoning, and digital leadership gives institutional support. The remaining challenge is to make these layers more consistent with one another through collaborative planning and assessment. This relationship is illustrated in the model of Figure 1.

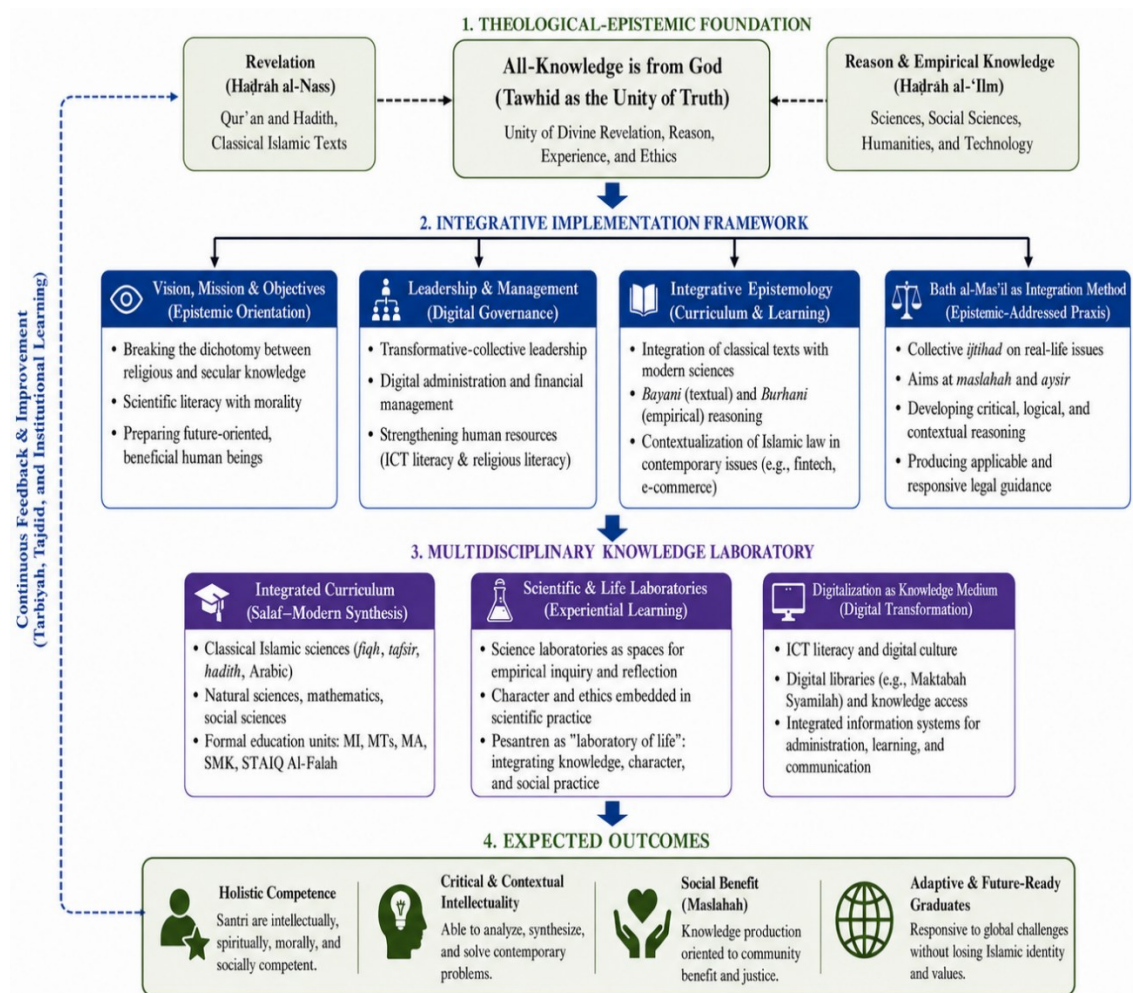


Fig. 1. Integrative Islam-science curriculum and instruction model in pesantren

Figure 1 shows an integrative Islam-science model linking epistemological foundation based on *tawhid* to curriculum architecture, instructional practice, *Bahtsul Masail*, digital leadership, and institutional support. The model underscores that integration is not achieved by merely juxtaposing religious and scientific subjects but requires coherence between institutional vision, curriculum content, pedagogy, assessment, and

academic culture. Its implementation aims at developing students' spiritual depth, scientific thinking, sense of responsibility, digital literacy and ability to solve modern social problems.

CONCLUSION

The conclusion of this study is the integration of Islam and science at Al-Falah Pesantren is not only based on the coexistence of religious and general subjects but also based on the interconnected education layer, namely, epistemological vision based on *tawhid*, hybrid curriculum structure, classroom and laboratory practices, *Bahtsul Masail* and digital institutional support. This integration was most evident in the use of classical Islamic texts, Qur'anic reflection, empirical observation, scientific reasoning, and ethical judgment together to address real issues such as environmental stewardship, laboratory discipline, digital transactions, health, and social responsibility. In this sense, Al-Falah is a growing model of pesantren education that tries to preserve the authority of *kitab kuning*, Qur'anic memorization, and religious habituation, while also creating structured space for science, technology, and contemporary problem-solving.

However, the findings also point out that the integration is still unbalanced among subjects, teachers and educational levels. Some practices such as contextual learning of fiqh, selected science lessons, laboratory activities, *Bahtsul Masail*, and the use of digital references already show meaningful integration. However, teacher collaboration, interdisciplinary planning, integrative assessment and systematic institutional review need to be strengthened further. The study makes a conceptual contribution by linking Abdullah's integration-interconnection framework with Fogarty's integrated curriculum model, and applying Bahm's concept of science to the study of scientific reasoning in pesantren instruction. In practice, the findings provide a feasible framework for pesantren and other religious educational institutions that would like to integrate spiritual formation, scientific literacy, ethical responsibility, digital competence, and contextual problem-solving. Future research should test this model in various pesantren typologies and employ comparative or mixed-methods research designs to examine its impact on students' scientific reasoning, religious understanding, ethical judgment, and problem-solving competence.

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