

Systemic Layered Integration of Islam and Science in Biology Education: A Qualitative Case Study at Universitas Muhammadiyah Sukabumi

¹Muhammad Thariq Aziz, ²Tobroni, ³Abdul Haris, ⁴Asrori Mukhtarom

^{1,2,3}Doctoral Program in Islamic Education, Universitas Muhammadiyah Malang, Indonesia

⁴Universitas Muhammadiyah Tangerang, Indonesia

Corresponding Author: Muhammad Thariq Aziz

ABSTRACT: The integration of Islam and science in Muslim higher education is frequently asserted at the level of institutional vision, yet its enactment often remains fragmented or limited to the attachment of scriptural references to scientific content. This study examines how Islam and science are conceptualized and implemented in the Biology Education Program at Universitas Muhammadiyah Sukabumi. The research employed a constructivist qualitative case study. Data were generated through interviews with university and faculty leaders, program managers, and Biology lecturers, supported by classroom observation and analysis of institutional policies, the Al Islam and Kemuhammadiyahan quality assurance standards, curriculum documents, graduate learning outcomes, and semester learning plans for General Biology and Ecology. Data were analyzed through iterative condensation, display, and conclusion drawing. The findings reveal a systemic layered architecture comprising philosophical, institutional, curricular, instructional, and cultural dimensions. Integration is anchored in a tauhidic vision, institutionalized through quality assurance and integration guidelines, translated into an Outcome Based Education and Merdeka Belajar Kampus Merdeka curriculum, enacted through learning outcomes, course content, active pedagogy, practical work, and assessment, and reinforced through an Islamic academic culture. Its sustainability is supported by leadership commitment, institutional regulation, lecturer development, infrastructure, and stakeholder participation. However, limited integrative literature, uneven lecturer competence, variable epistemological depth, weak authentic assessment, and unequal student literacy constrain substantive implementation. The study contributes a systemic layered model and argues that meaningful integration requires alignment between epistemic vision, institutional governance, pedagogy, assessment, and academic culture.

KEYWORDS: Islam and science integration; Biology education; Muhammadiyah higher education; qualitative case study; curriculum; systemic layered model

Date of Submission: 01-08-2026

Date of acceptance: 07-08-2026

I. INTRODUCTION

The relation between religion and science remains a central problem in contemporary Muslim education because it concerns more than the coexistence of two bodies of knowledge. It concerns the ontology of knowledge, the authority assigned to revelation and empirical inquiry, and the ethical ends toward which scientific competence is directed. Modern educational institutions often organize knowledge into disciplinary compartments, while Islamic educational discourse normatively affirms the unity of knowledge. The resulting tension is not resolved by declaring that Islam supports science. It requires institutional arrangements and pedagogical practices capable of translating a tauhidic worldview into intellectually responsible learning experiences (Amin Abdullah, 2014; Edison, Hitami and Anwar, 2021; Juhana, Natsir and Haryanti, 2022). Recent analyses of Indonesian Islamic higher education further show that the institutionalization of integration depends on academic reform, spirituality-oriented curriculum design, explicit science-religion policies, and the capacity of universities to negotiate global standards without losing their normative identity (Chanifah *et al.*, 2021; Irham, 2025; Muthohirin, 2025; Sudirman *et al.*, 2025).

The problem becomes particularly visible in Biology education. Biology examines life, organisms, bodies, ecosystems, heredity, and environmental change. These objects invite reflection on creation, stewardship, bioethics, health, and ecological responsibility. At the same time, Biology is grounded in empirical observation, experimentation, theoretical explanation, and the possibility of revision. Consequently, integration cannot legitimately mean that scriptural texts replace scientific methods or that biological theories are judged solely through isolated quotations. It must enable dialogical relations between scientific explanation, Islamic ethical reasoning, and the lived consequences of knowledge (Ramadhan, Dwiningrum and Subhan, 2021; Herlanti, Noor

and Zein, 2022; Febril, 2023). Studies of evolution education show that these tensions become especially visible when biological explanations intersect with religious commitments. Acceptance is shaped not only by content knowledge, but also by conceptual ecology, teacher mediation, and the way classroom discourse frames the relation between science and religion (Rachmatullah, Park and Ha, 2022; Stahi-Hitin and Yarden, 2022a, 2022b; Haviz *et al.*, 2024; Saefi, Suwono and Hanafi, 2024).

Recent studies have developed learning models, modules, and instructional resources that connect Islamic values with Biology. The RQANI model demonstrates that science concepts and Islamic values can be organized systematically in Biology learning (Amin *et al.*, 2022). Pedagogical Content Islamic Knowledge extends teacher knowledge by bringing Islamic values into the relation among content and pedagogy (Herlanti, Noor and Zein, 2022). Studies of reproductive systems, ecology, and secondary school Biology similarly show that integrative materials can strengthen critical thinking, environmental responsibility, and value oriented reflection (Nawawi and Wijayanti, 2022; Zahro' *et al.*, 2023; Fuadah, Zulfiani and Solihin, 2024). These contributions are important, but much of the literature remains concentrated on particular learning products, courses, or student perceptions. Evidence from school contexts also indicates that collaborative and dialogical pedagogies enable teachers to move beyond one-directional confirmation toward more explicit argumentation about epistemic boundaries (Chan and Erduran, 2023; Riwanda, Gonibala and Ahmad, 2025).

A significant gap therefore concerns the institutional ecology of integration. A course does not operate independently from university vision, quality assurance, curriculum architecture, lecturer development, assessment policy, and academic culture. When these layers are disconnected, integration is vulnerable to becoming symbolic. It may appear in the wording of a semester plan while remaining absent from classroom discourse, assessment, and student experience. Conversely, when institutional and pedagogical layers are aligned, integration can become a sustained educational practice rather than an individual lecturer's improvisation (Khozin, Haris and Asrori, 2021; Handoko *et al.*, 2024; Mufanti, Carter and England, 2024). Research on science-religion encounters and curriculum reform suggests that such alignment requires attention to epistemic boundaries, teacher questioning, moderation-oriented curriculum design, and the institutional integration of traditional and modern educational aims (Bowie *et al.*, 2023; Rohman *et al.*, 2023; Mukhibat *et al.*, 2024; Revell *et al.*, 2024).

Universitas Muhammadiyah Sukabumi, hereafter UMMI, offers a productive case for examining this problem. As a Muhammadiyah university, UMMI articulates the vision of excellence in science and Islam and places Al Islam and Kemuhammadiyahan, hereafter AIK, within its Catur Dharma. Its Biology Education Program combines an Outcome Based Education curriculum, Merdeka Belajar Kampus Merdeka flexibility, differentiated and lifelong learning, local wisdom, and sustainable development. The case therefore allows an analysis of how a religiously grounded institutional identity is translated into curriculum and classroom practice.

This article addresses three questions. First, how is the integration of Islam and science conceptualized at UMMI? Second, how is that concept implemented in the Biology Education curriculum and learning process? Third, which conditions support or constrain its implementation? The article contributes a systemic layered model that interprets integration as an alignment among philosophical, institutional, curricular, instructional, and cultural dimensions. This contribution shifts the analytical focus from the presence of religious content toward the relations that make integration coherent, assessable, and educationally transformative.

II. METHODOLOGY

This study was located within a constructivist paradigm. Ontologically, integration was treated not as a fixed property that can be identified merely by counting scriptural references, but as a socially and institutionally produced reality. Epistemologically, knowledge about integration was generated through the interpretations of actors, policy texts, curricular artefacts, and observed practices. This position required the analysis to distinguish between institutional self descriptions, formal expectations, and enacted classroom realities.

A qualitative case study design was selected because the phenomenon was inseparable from its organizational and pedagogical context (Yin, 2018). The bounded case was the integration of Islam and science in the Biology Education Program, Faculty of Teacher Training and Education, UMMI. The case was examined across the university, faculty, program, and course levels so that vertical consistency and horizontal relations could be analyzed rather than assumed.

Participants were selected purposively because of their direct involvement in policy formulation, curriculum development, quality assurance, or Biology teaching. They included the Vice Rector responsible for academic affairs and AIK, the head of the AIK institution, the Dean of the Faculty of Teacher Training and Education, the head of the Biology Education Program, and lecturers responsible for Biology courses, including General Biology and Ecology. The study did not seek statistical representation. It sought information rich perspectives capable of explaining institutional intentions, implementation processes, and practical tensions.

Data were generated through semistructured interviews, direct observation, and document analysis. Institutional documents included the university, faculty, and program visions and missions, AIK Internal Quality Assurance standards, the AIK integration guideline, curriculum development documents, graduate profiles, graduate learning outcomes, the course structure, and semester learning plans for General Biology and Ecology.

Observation focused on the academic environment and learning practices. Documents were treated as normative and performative artefacts. They were not considered transparent proof of implementation, but were compared with interview accounts and observed practices.

Analysis followed the interactive procedures of data condensation, data display, and conclusion drawing proposed by Miles, Huberman, and Saldana (Miles, M.B, Huberman, A.M, dan Saldana, 2014). Initial coding identified statements and evidence concerning conceptual foundations, institutional regulation, curriculum design, instructional enactment, academic culture, supporting conditions, and constraints. Codes were progressively grouped into analytical categories and then interpreted across institutional levels. Credibility was strengthened through triangulation among interviews, observations, and documents. Reflexive attention was directed to the possibility that the strong normative language of Islamic higher education could obscure uneven enactment. Accordingly, claims of integration were accepted only when relationships among policy, curriculum, teaching, and assessment could be demonstrated.

III. FINDINGS

A. A Systemic Layered Conceptual Architecture

The first finding is that UMMI conceptualizes integration as an institutional architecture rather than a single classroom technique. The university vision, which emphasizes excellence in science and Islam, provides a philosophical orientation that rejects the assumption that scientific competence and religious formation are separate educational projects. In the interpretation of university leaders, excellence is not exhausted by accreditation, research output, or mastery of technology. It also includes moral integrity, social usefulness, and accountability before God. This produces a tauhidic orientation in which knowledge is understood as both intellectual achievement and ethical trust.

The vision is vertically translated into faculty and program formulations. The Faculty of Teacher Training and Education defines professional and Islamic teacher education as an integrated mandate. The Biology Education Program further specifies Islamic Biology learning, differentiated and lifelong learning, local wisdom, and sustainable development. This vertical continuity is analytically significant. It indicates that integration is not merely added to a discipline after curriculum design has been completed. It functions as a criterion through which graduate identity, pedagogical orientation, and social relevance are framed.

At the institutional level, integration is regulated through the AIK Internal Quality Assurance System and the AIK integration guideline. The quality system includes standards for institutional governance, Islamic campus culture, human resources, integration of knowledge, research, community service, student development, cooperation, financing, course competence, and AIK content. The integration standard requires guidance, a road map, lecturer development, integrated books, and publication. It also establishes indicators for the incorporation of AIK into semester learning plans. Integration is therefore positioned within a quality cycle rather than left entirely to personal enthusiasm.

The institutional guideline recognizes multiple intellectual routes, including Islamization of knowledge, integration of knowledge, and the scientification of Islam. UMMI does not adopt these as mutually exclusive slogans. In practice, it privileges an integrative and interconnected orientation that allows revelation, philosophy, and empirical science to enter a critical dialogue while maintaining the methodological identity of each field. The important implication is that integration is not defined as total fusion. Biology retains its empirical objects and methods, while Islamic sources contribute ethical orientation, metaphysical horizon, and critical questions about human responsibility.

The evidence generated five interdependent layers. The philosophical layer concerns the tauhidic meaning of knowledge. The institutional layer concerns governance, quality standards, and organizational responsibility. The curricular layer concerns graduate outcomes, course structure, and curriculum alignment. The instructional layer concerns semester plans, teaching methods, practical work, and assessment. The cultural layer concerns routines, relationships, worship, ethical conduct, and the Islamic atmosphere of the campus. The layers are systemic because weakness at one level affects the others, and they are layered because integration moves from macro commitments to micro encounters in classrooms and laboratories.

Table 1: Layers of Islam and science integration at UMMI

Layer	Empirical manifestation	Interpretive significance
Philosophical	Vision of excellence in science and Islam; tauhidic meaning of knowledge	Defines the moral purpose and ontological unity of learning
Institutional	SPMI AIK, integration guideline, LAIK, leadership, Catur Dharma	Converts normative commitment into governance and quality responsibility
Curricular	OBE and MBKM curriculum, graduate profiles, CPL, course structure	Aligns scientific, pedagogical, digital, ethical, and Islamic competencies

Layer	Empirical manifestation	Interpretive significance
Instructional	RPS, content, discussion, cases, practicum, LMS, assessment	Makes integration visible in learning activities and evidence of achievement
Cultural	Worship, ethical conduct, academic routines, campus Islamic culture	Operates as a hidden curriculum that normalizes values in daily practice

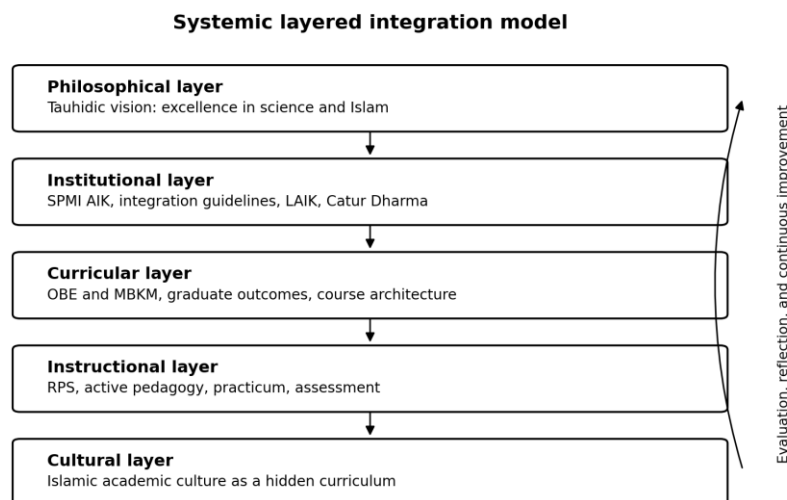


Figure 1: Systemic layered model derived from the case findings

B. Curricular Institutionalization of Integration

The second finding is that integration is embedded in the Biology Education curriculum through an Outcome Based Education orientation and Merdeka Belajar Kampus Merdeka flexibility. The curriculum was developed through a process that combined university direction with input from lecturers, students, alumni, professional associations, and users of graduates. This top down and bottom up movement is important because it links institutional identity with professional relevance. It also reduces the likelihood that Islamic commitments are formulated without regard to the competencies expected of contemporary Biology educators.

Graduate profiles include Biology teachers for boarding schools, teachers for nature based schools, research assistants, and bioentrepreneurs. Each profile provides a distinct site for integration. The boarding school profile links scientific and pedagogical competence with spiritual mentoring and communal educational life. The nature based school profile connects ecological knowledge, local wisdom, and stewardship. The research assistant profile brings scientific integrity, research ethics, and social responsibility into laboratory and field work. The bioentrepreneur profile connects biological innovation with lawful enterprise, sustainability, and social benefit. Integration therefore functions differently across professional contexts rather than being reduced to one generic moral formula.

Graduate learning outcomes combine personal discipline, responsibility, complex thinking, communication, digital literacy, biological knowledge, curriculum and assessment competence, and the ability to design Biology learning informed by the Qur'an and Sunnah. This structure preserves the disciplinary core of Biology. The curriculum does not replace genetics, ecology, microbiology, physiology, or pedagogy with religious studies. Instead, it adds a normative and reflective dimension to how these fields are learned, taught, and used. Such a design is consistent with the integrative interconnective position in which disciplinary boundaries remain visible but are opened to responsible dialogue (Amin Abdullah, 2014).

The course architecture also shows that AIK and character formation are not confined to separate religious courses. They are expected to inform professional and pedagogical subjects. Nevertheless, the depth of integration differs among courses. Courses dealing with ecology, biodiversity, health, and human physiology provide relatively accessible connections with stewardship, balance, gratitude, hygiene, and responsibility. Courses involving evolution, systematics, or complex molecular mechanisms require more careful epistemological work because superficial harmonization can distort both scientific explanation and religious interpretation.

C. Instructional Enactment in General Biology and Ecology

The semester learning plans for General Biology and Ecology provide the clearest evidence that integration has moved from curriculum statements into instructional design. In General Biology, course outcomes combine

the mastery of biological concepts with Islamic values and academic ethics. Topics such as scientific method, cells, metabolism, biodiversity, organ systems, and the diversity of life are accompanied by opportunities for reflection on the order of creation, responsible use of the body, gratitude, and the moral consequences of scientific knowledge. The plan also places honesty, accuracy, discipline, and responsibility within laboratory practice. These values are pedagogically relevant because they are integral to scientific integrity rather than external moral decoration.

The Ecology plan demonstrates an even stronger relation among scientific content, Islamic ethics, and social context. It moves from the definition and scope of ecology to organization of life, population dynamics, species distribution, communities, ecosystems, and spatial relations. Selected Qur'anic references are associated with the order of nature, diversity, and human responsibility. More importantly, students are required to search for ecological data, analyze journals, discuss cases, and examine environmental problems. This design allows religious values to function as ethical and interpretive questions within empirical inquiry rather than as substitutes for evidence. This orientation is consistent with studies showing that environmental responsibility becomes educationally meaningful when Islamic ethics are embedded in curricular content and connected to concrete practices such as energy conservation and ecological action (Wakhidah and Erman, 2022; Rohmatulloh *et al.*, 2023).

Teaching strategies include lectures, group discussion, case studies, presentation, independent inquiry, and blended learning through Google Classroom, Google Meet, and the UMMI learning management system. The Ecology plan explicitly incorporates technological literacy, data literacy, and human literacy. This combination supports critical thinking, collaboration, communication, and digital competence. It also demonstrates that integration is not pedagogically equivalent to religious lecturing. It is enacted through activities in which students interpret data, deliberate about consequences, and articulate scientifically informed ethical positions.

Assessment is aligned with course outcomes through summaries, literature reviews, journal analysis, practical reports, mid semester examinations, and final examinations. The alignment indicates that integration has entered the logic of curriculum design. However, documentary evidence also shows that written products and cognitive testing remain dominant. The assessment of ecological responsibility, research ethics, spiritual reflection, or the ability to integrate scientific evidence with ethical reasoning is not yet consistently supported by specific rubrics. The presence of Islamic values in outcomes therefore exceeds the sophistication of the instruments used to assess them.

The instructional evidence suggests a movement from symbolic toward substantive integration. Symbolic integration is visible when a verse is attached to a topic without altering inquiry, explanation, or evaluation. Substantive integration appears when a scientific concept is connected with ethical reasoning, contextual problems, student reflection, and assessable action. UMMI exhibits both tendencies. Its learning plans create a substantial foundation, yet the actual depth remains dependent on lecturer competence, available literature, and the design of learning tasks.

D. Supporting and Constraining Conditions

Implementation is supported by several mutually reinforcing conditions. Leadership commitment provides policy authority and financial legitimacy. The AIK institution and quality assurance system provide organizational continuity. Lecturer workshops support the preparation of integrated semester plans and teaching materials. Infrastructure, including classrooms, laboratories, digital platforms, and access to learning resources, enables varied pedagogical strategies. Stakeholder participation improves curriculum relevance. Islamic campus routines, including collective worship, study circles, and norms of academic conduct, operate as a hidden curriculum that reinforces values beyond formal lessons.

These supports matter because integration is demanding intellectual work. Biology lecturers are expected to understand Islamic sources, educational theory, and disciplinary science, while AIK specialists require sufficient understanding of biological concepts to avoid inappropriate analogies. Institutional collaboration can distribute this burden and create a community of interpretation. Where collaboration is weak, integration becomes dependent on individual confidence and may vary considerably across courses.

The most immediate constraint is the limited availability of integrative books and literature. Lecturers may have strong Biology references and separate Islamic references, but few resources demonstrate how to build a methodologically sound relation between them. The consequence is a risk of verse attachment, in which a scriptural quotation is selected because it appears linguistically similar to a scientific topic. This practice can produce a sense of religious relevance, but it does not necessarily generate epistemological dialogue or critical understanding.

A second constraint is uneven human resource readiness. Some lecturers can connect Biology, Islamic ethics, local contexts, and active pedagogy in a coherent manner. Others remain at the level of administrative inclusion in the semester plan. This variation should not be reduced to personal deficiency. It reflects the

complexity of integrative competence and the need for sustained mentoring, joint teaching, peer review of materials, and discipline specific workshops.

A third constraint concerns assessment and evaluative research. The university has clear indicators for documents and training, but fewer instruments for judging the depth of classroom integration and its effects on students. The risk is that quality assurance becomes document centered. Meaningful evaluation requires observation of learning, analysis of student work, reflective feedback, authentic assessment, and research on conceptual understanding, scientific attitudes, ethical judgment, environmental responsibility, and readiness to teach integrated Biology.

A fourth constraint is student literacy. Integration requires scientific literacy and Islamic literacy at the same time. Students who understand Biology but lack contextual reading of religious sources may produce general moral statements. Students with religious knowledge but weak scientific literacy may oversimplify biological concepts. Instruction therefore needs a gradual structure that strengthens disciplinary understanding before asking students to produce complex integrative interpretations.

IV. DISCUSSION

The findings indicate that the central unit of analysis in Islam and science integration should not be the isolated lesson. It should be the academic ecosystem. This conclusion extends studies that focus on models, modules, and classroom strategies by showing that pedagogical innovation is shaped by institutional meaning, quality assurance, curriculum alignment, lecturer capability, and cultural reinforcement. The systemic layered model explains why apparently similar semester plans can produce different educational experiences. The written curriculum is mediated by organizational support and by the lecturer's capacity to transform normative claims into inquiry, dialogue, and assessment.

The model also clarifies the ontological claim implicit in UMMI's vision. A tauhidic ontology does not imply that all knowledge has one method. It asserts that reality, knowledge, value, and human responsibility cannot be treated as unrelated domains. Biology investigates living systems through empirical and theoretical procedures, while Islamic thought raises questions concerning purpose, stewardship, ethical limits, and accountability. Integration becomes intellectually defensible when these domains illuminate different aspects of a problem without forcing premature equivalence. This interpretation is consistent with Amin Abdullah's integrative interconnective paradigm, which seeks communication among religious texts, empirical sciences, and critical philosophy (Amin Abdullah, 2014; Juhana, Natsir and Haryanti, 2022). Recent Islamic educational and philosophical scholarship similarly argues that religious education should form moral agency while distinguishing scriptural, rational, and nomic forms of judgment, thereby preventing an indiscriminate collapse of scientific and theological claims (Agbaria, 2018; Malik, 2025).

The distinction between symbolic and substantive integration is especially important. Symbolic integration may have an initiating function because it signals that scientific learning is not religiously neutral in its consequences. Nevertheless, it becomes problematic when textual similarity is treated as scientific verification. The Qur'an is then reduced to a repository of scientific predictions, while science is used to validate scripture. Substantive integration requires a more modest and critical relation. Scientific claims must remain accountable to evidence, while Islamic sources inform ethical judgment, existential meaning, and the direction of application. This avoids both the theologization of scientific method and the scientification of revelation (Ihsan *et al.*, 2021; Febril, 2023).

Curricular alignment through Outcome Based Education offers an opportunity and a danger. The opportunity lies in making values explicit within graduate outcomes, course outcomes, learning activities, and assessment. The danger lies in bureaucratic formalization. Outcomes can become phrases that satisfy documentation requirements without changing pedagogical practice. (Mufanti, Carter and England, 2024) show that Outcome Based Education in Indonesian higher education depends heavily on teacher understanding and institutional support. The UMMI case confirms this point. Alignment is meaningful only when lecturers can design evidence of learning that captures scientific reasoning and ethical judgment together.

The Ecology course illustrates the transformative potential of integration. Environmental problems are not solved solely through knowledge of populations, communities, or ecosystems. They also involve consumption, power, justice, responsibility, and the moral status of nonhuman life. Connecting ecological data with stewardship and public benefit can therefore deepen rather than weaken scientific learning. Studies of Islamic values and ecopreneurship in Biology similarly show that sustainability becomes educationally meaningful when values are connected with inquiry and action (Fuadah, Zulfiani and Solihin, 2024). The UMMI model is strongest where local environmental realities, scientific analysis, and Islamic ethics meet.

Teacher education gives the model broader significance. Graduates will not merely reproduce university content. They will interpret Biology for school students who inhabit diverse religious, cultural, and digital environments. Integrative competence therefore includes the ability to protect scientific accuracy, facilitate respectful theological questions, use technology, design inclusive learning, and evaluate ethical reasoning. The concept of Pedagogical Content Islamic Knowledge is relevant because it recognizes that knowing Biology and

knowing Islamic values separately do not automatically produce integrative teaching (Herlanti, Noor and Zein, 2022). UMMI's systemic approach can support this competence, provided lecturer collaboration and assessment are strengthened.

The cultural layer requires critical attention. An Islamic campus atmosphere can strengthen consistency between formal curriculum and lived experience. It can cultivate discipline, respect, honesty, and communal responsibility. Yet culture should not be romanticized. Hidden curricula may also normalize compliance without reflection. A transformative academic culture must therefore permit questioning, intellectual disagreement, and critical discussion. Religious identity becomes educationally powerful when it supports epistemic humility and moral courage, not when it closes inquiry.

The practical implication is that universities seeking integration should work simultaneously at several levels. They need a clear philosophical statement, an accountable institutional structure, curriculum mapping, course specific integration guides, lecturer learning communities, collaborative authorship of materials, authentic assessment rubrics, and research on student outcomes. Isolated workshops or compulsory insertion of verses are insufficient. Continuous improvement should move in both directions: policy should guide practice, while classroom evidence should revise policy.

V.CONCLUSION

The integration of Islam and science in the Biology Education Program at UMMI is best understood as a systemic layered process. It begins with a tauhidic institutional vision, is organized through AIK governance and quality assurance, is translated into an Outcome Based Education and Merdeka Belajar Kampus Merdeka curriculum, is enacted through semester plans and learning activities, and is reinforced through an Islamic academic culture. This architecture distinguishes integration as an academic ecosystem from integration as a rhetorical statement.

The case also reveals a transitional condition. UMMI has moved beyond purely normative commitment because integration is visible in graduate outcomes, course content, learning methods, digital platforms, practicum ethics, and assessment plans. However, substantive depth remains uneven. Limited integrative literature, unequal lecturer readiness, risks of verse attachment, weak authentic assessment, and differences in student literacy prevent the institutional design from being realized consistently across all courses.

The theoretical contribution of the study is the systemic layered model, which explains integration through the alignment of philosophical, institutional, curricular, instructional, and cultural dimensions. The practical implication is that strengthening one layer without the others will produce fragile results. Universities should develop discipline specific road maps, collaborative lecturer mentoring, integrated teaching resources, assessment rubrics, and evaluative research that examines changes in scientific understanding, ethical reasoning, environmental responsibility, and professional teaching competence.

This study is limited to one Muhammadiyah university and gives particular attention to selected institutional documents and the General Biology and Ecology learning plans. It does not provide longitudinal evidence of student transformation or comparative evidence across institutions. Further research should examine classroom interaction in greater depth, compare different Biology courses and universities, and investigate how graduates enact integration in schools, laboratories, environmental programs, and biological enterprises.

REFERENCES

- [1] M. Amin Abdullah, "Religion, science and culture: An integrated, interconnected paradigm of science," *Al-Jami'ah*, vol. 52, no. 1, 2014, doi: 10.14421/ajis.2014.521.175-203.
- [2] E. Edison, M. Hitami, and A. Anwar, "Persepsi dan implementasi integrasi Islam dan sains di SMA IT Al Ihsan Pekanbaru," ... *Pendidikan Islam*, 2021, [Online]. Available: <http://ejournal.uika-bogor.ac.id/index.php/TADIBUNA/article/view/5009>
- [3] H. Juhana, N. F. Natsir, and E. Haryanti, "Integrasi Ilmu M. Amin Abdullah dan Kuntowijoyo," *Jiip - Jurnal Ilmiah Ilmu Pendidikan*, vol. 5, no. 1, 2022, doi: 10.54371/jiip.v5i1.397.
- [4] N. Chanifah, Y. Hanafi, C. Mahfud, and A. Samsudin, "Designing a spirituality-based Islamic education framework for young Muslim generations: A case study from two Indonesian universities," *High. Educ. Pedagog.*, vol. 6, no. 1, pp. 195–211, 2021, doi: 10.1080/23752696.2021.1960879.
- [5] Irham, "Policies and patterns of integration of science and religion in Indonesian Islamic higher education," *High. Educ. (Dordr.)*, vol. 90, no. 5, 2025, doi: 10.1007/s10734-024-01378-9.
- [6] N. Muthohirin, "Revitalizing Islamic studies: a two-decade conversion in Indonesia's state Islamic universities," *Social Sciences and Humanities Open*, vol. 12, 2025, doi: 10.1016/j.ssaho.2025.102153.
- [7] S. Sudirman, R. Ramadhita, S. Bachri, and Y. Whindari, "The transformation of state islamic higher education institutions into World-Class University: From globalisation to institutional values," *Social Sciences and Humanities Open*, vol. 12, 2025, doi: 10.1016/j.ssaho.2025.101705.
- [8] A. N. Ramadhan, S. I. A. Dwiningrum, and B. Subhan, "Potensi Integrasi Pembelajaran Biologi dengan Pembelajaran Quran-Hadis," *AL QUDS : Jurnal Studi Alquran dan Hadis*, vol. 5, no. 1, p. 263, Apr. 2021, doi: 10.29240/alquds.v5i1.2355.
- [9] Y. Herlanti, M. F. Noor, and N. Zein, "The Integration Of Islamic Values And Biology Education Using Pedagogical Content Islamic Knowledge (PCIK)," 2022. doi: 10.31603/tarbiyatuna.v13i1.6103 LK - <https://doi.org/10.31603/tarbiyatuna.v13i1.6103>.
- [10] A. N. Febriil, "INTEGRASI ISLAM-SAINS DAN IMPLEMENTASINYA DALAM PEMBELAJARAN BIOLOGI," *Al-Alam: Islamic Natural Science Education Journal*, vol. 2, no. 2, pp. 89–96, Jul. 2023, doi: 10.33477/al-alam.v2i2.5105.
- [11] A. Rachmatullah, S. Park, and M. Ha, "Crossing borders between science and religion: Muslim Indonesian biology teachers' perceptions of teaching the theory of evolution," *Cult. Stud. Sci. Educ.*, vol. 17, no. 2, 2022, doi: 10.1007/s11422-021-10066-4.

- [12] R. Stahi-Hitin and A. Yarden, "Evolution education in light of religious science teachers' and scientists' conceptions of evolution and religion," *Evolution: Education and Outreach*, vol. 15, no. 1, 2022, doi: 10.1186/s12052-022-00167-1.
- [13] R. Stahi-Hitin and A. Yarden, "Scientists' and teachers' attitudes toward relating to religion when teaching evolution," *Evolution: Education and Outreach*, vol. 15, no. 1, p. 18, 2022, doi: 10.1186/s12052-022-00176-0.
- [14] M. Haviz, R. Helmita, Ervina, David, and I. M. Maris, "Muslim Indonesian prospective biology teachers' acceptance and typology of the theory of evolution," *Evolution: Education and Outreach*, vol. 17, no. 1, 2024, doi: 10.1186/s12052-024-00206-z.
- [15] M. Saefi, H. Suwono, and Y. Hanafi, "From conflict to harmony: changing conceptual ecology of evolution acceptance of muslim students after dialogue in science and religion," *Evolution: Education and Outreach*, vol. 17, no. 1, 2024, doi: 10.1186/s12052-024-00199-9.
- [16] A. M. Amin, S. H. Ahmad, Zulkarnaim, and R. Adiansyah, "RQANI: A learning model that integrates science concepts and Islamic values in biology learning," *International Journal of Instruction*, vol. 15, no. 3, pp. 695–718, 2022, doi: 10.29333/iji.2022.15338a.
- [17] S. Nawawi and T. F. Wijayanti, "Pengembangan Modul Sistem Reproduksi Berbasis Berpikir Kritis Terintegrasi Nilai Islam dan Kemuhammadiyah," *Jurnal Inovasi Pendidikan IPA*, vol. 7, no. 2, 2022, doi: 10.21831/jipi.v7i2.39018.
- [18] A. I. Fuadah, Zulfiani, and Solihin, "Integrating islamic values and ecopreneurship in biology: E-lkpd as a learning tool," *Biosfer*, vol. 17, no. 2, pp. 383–395, Oct. 2024, doi: 10.21009/biosferjpb.40375.
- [19] A. Zahro', M. Muzazzinah, M. Ramli, and E. Wulandari, "Literature Study of Islamic Values Integration in Biology Subject in SMA/MA (Senior High Schools/Islamic Senior High School)," *Biosfer: Jurnal Tadris Biologi*, vol. 13, no. 2, 2023, doi: 10.24042/biosfer.v13i2.14109.
- [20] J. Chan and S. Erduran, "The impact of collaboration between science and religious education teachers on their understanding and views of argumentation," *Res. Sci. Educ.*, vol. 53, no. 1, pp. 121–137, 2023, doi: 10.1007/s11165-022-10041-1.
- [21] A. Riwanda, A. Gonibala, and J. Ahmad, "Science and religion integration in Indonesian Islamic senior high schools: Analyzing teachers' pedagogical practices," *Sci. Educ. (Dordr.)*, 2025, doi: 10.1007/s11191-025-00648-x.
- [22] K. Khozin, A. Haris, and A. Asrori, "Pengembangan Integrasi Kurikulum," *TADARUS*, vol. 10, no. 1, 2021, doi: 10.30651/td.v10i1.9090.
- [23] R. Mufanti, D. Carter, and N. England, "Outcomes-based education in Indonesian higher education: Reporting on the understanding, challenges, and support available to teachers," *Social Sciences and Humanities Open*, vol. 9, 2024, doi: 10.1016/j.ssaho.2024.100873.
- [24] A. Handoko, D. Febtiana, N. Hidayah, N. B. Haka, M. Mazalena, and H. Darmayanti, "An Analysis of the Integration of Islamic Values in Science Learning at State Islamic Junior High School," *Biosfer: Jurnal Tadris Biologi*, vol. 15, no. 2, p. 193, Dec. 2024, doi: 10.24042/biosfer.v15i2.24453.
- [25] A. Rohman, S. Muhtamiroh, A. Imron, and N. Miyono, "Integrating traditional-modern education in madrasa to promote competitive graduates in the globalization era," *Cogent Education*, vol. 10, no. 2, 2023, doi: 10.1080/2331186X.2023.2268456.
- [26] M. Mukhibat, M. Effendi, W. H. Setyawan, and M. Sutoyo, "Development and evaluation of religious moderation education curriculum at higher education in Indonesia," *Cogent Education*, vol. 11, no. 1, 2024, doi: 10.1080/2331186X.2024.2302308.
- [27] L. Revell, B. Bowie, M. Woolley, and J.-P. Riordan, "Teachers' use of questions and the science/religion encounter: Basil Bernstein and the impossibility of the unthinkable," *Journal of Religious Education*, vol. 72, no. 3, 2024, doi: 10.1007/s40839-024-00245-0.
- [28] R. A. Bowie *et al.*, "Science-religion encounters, epistemic trespass, neighbourliness and overlapping domains," *Journal of Religious Education*, vol. 71, no. 3, pp. 279–295, 2023, doi: 10.1007/s40839-023-00209-w.
- [29] R. K. Yin, "Case study research and applications," *Sage Publications*, 2018.
- [30] J. Miles, M.B. Huberman, A.M. dan Saldana, "4. Qualitative Data Analysis, A Methods Sourcebook, Edition 3. USA: Sage Publications. Terjemahan Tjetjep Rohindi Rohidi, UI-Press., "4. Qualitative Data Analysis, A Methods Sourcebook, Edition 3. USA: Sage Publications., 2014.
- [31] N. Wakhidah and E. Erman, "Examining environmental education content on Indonesian Islamic religious curriculum and its implementation in life," *Cogent Education*, vol. 9, no. 1, p. 2034244, 2022, doi: 10.1080/2331186X.2022.2034244.
- [32] R. Rohmatulloh, A. Hasanah, L. Sahlani, and M. T. Zuhri, "Energy-Saving Triangle: Internalizing Islamic Ethical Values on Energy Saving in Integrative Learning," *Religions (Basel)*, vol. 14, no. 10, 2023, doi: 10.3390/rel14101284.
- [33] A. K. Agbaria, "State Accommodation of Islamic Education: Review of Policy Frameworks," *Al Qasemi Journal of Islamic Studies*, 2018, [Online]. Available: <https://platform.almanhal.com/Files/Articles/129538>
- [34] S. A. Malik, "Science as Divine Signs: Al-Sanūsī's Framework of Legal (shar'ī), Nomic (ʿādī), and Rational (ʿaqlī) Judgements," *Religions (Basel)*, vol. 16, no. 5, 2025, doi: 10.3390/rel16050549.
- [35] N. H. Ihsan, K. Amrullah, U. Khakim, and H. Fatkhurizka, "Hubungan Agama dan Sains: Telaah Kritis Sejarah Filsafat Sains Islam dan Modern," *Intizar*, vol. 27, no. 2, pp. 97–111, Nov. 2021, doi: 10.19109/intizar.v27i2.9527.