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Integration and Interconnection of Islam and Science to Strengthen the Islamic Education Curriculum

Safna Febriyani[1*], Haris Riadi[1], Betti Fariati[1]

[1] Institut Agama Islam Negeri (IAIN) Datuk Laksemana Bengkalis, Riau Indonesia
Corresponding author email: Febriyanisafna@yahoo.com

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ABSTRACT

The Islamic Religious Education (PAI) curriculum plays a strategic role in shaping students who are not only religiously devout but also scientifically literate and responsive to the dynamics of modern civilization. The integration and interconnection between Islam and science serves as a crucial paradigm for strengthening the PAI curriculum, preventing the dichotomy between religious and scientific knowledge. This study aims to examine the concept of Islamic–scientific integration and interconnection and its implications for reinforcing the PAI curriculum in the modern era. This research employs a library research method with a descriptive-analytical approach. The findings indicate that the integration of Islam and science positions revelation (the Qur'an and Hadith) as the primary source of knowledge that aligns with the empirical findings of modern science. This approach enriches the PAI curriculum by harmoniously linking spiritual, moral, and rational values, making Islamic education more contextual, relevant, and meaningful. Therefore, strengthening the PAI curriculum through the integration and interconnection of Islam and science can foster a generation that is religiously grounded, intellectually critical, and scientifically insightful, ready to face the challenges of the era of artificial intelligence and globalization.

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INTRODUCTION

The rapid development of science and technology (IPTEK) in the 21st century demands that education innovate in its curriculum approaches and content. As an integral part of the national education system, Islamic Religious Education (PAI) is responsible for preparing students who are not only devout and pious but also possess adequate intellectual abilities and scientific skills. In this context, the concept of integration and interconnection between Islam and science is highly relevant for strengthening the PAI curriculum, making it more contextual and adaptive to changing times (Nasir, 2022). The integration and interconnection of Islam and science is a paradigm that seeks to unite two primary dimensions within humanity: spirituality

and rationality. In the Islamic perspective, knowledge does not exist autonomously from divine values, but rather originates and is oriented toward recognizing Allah SWT as al-'Alim, the source of all knowledge. Therefore, the pursuit of knowledge in Islam is not merely for practical or material purposes, but also as a form of devotion and responsibility for humans as caliphs on earth. The history of Islamic civilization demonstrates that advances in science and technology during the golden age of Islam *(8th to 14th centuries CE)* arose from an integral Islamic worldview, which does not separate revelation and reason as two complementary sources of truth (Haneef, 2005).

Muslim scientists such as Al-Farabi, Ibn Sina, Al-Biruni, and Ibn Khaldun represent this integrative spirit. They not only mastered rational sciences such as philosophy, medicine, astronomy, and sociology, but also possessed a strong spiritual foundation in understanding the nature of knowledge. Al-Farabi, for example, developed a theory of happiness based on the perfection of reason and closeness to God. Ibn Sina, in Al-Qanun fi al-Tibb (*The Law of the Prophet),* demonstrated that science and religious ethics can go hand in hand for the benefit of humanity. Meanwhile, Al-Biruni, in his astronomical research, always linked the order of the universe to the greatness of the Creator, and Ibn Khaldun, in his Muqaddimah *(The Introduction),* emphasized that social phenomena and human history cannot be understood without recognizing the divine will behind them (Sabarudin et al., 2024).

The concept of the integration and interconnection of Islam and science is thus not a new idea, but rather a revitalization of the classical Islamic scientific tradition, which has long placed revelation and reason in epistemological harmony. In the modern era, this idea has become highly relevant as a response to the dichotomy between religious and general knowledge that still frequently occurs in the education system. This integration emphasizes that knowledge must be directed towards strengthening faith, building ethics, and making a positive contribution to humanity. By uniting spiritual and rational values within a single epistemological unity, Islamic education is expected to produce a generation of ulul albab *(leaders of the sciences)* who are intellectually intelligent, spiritually profound, and virtuous in managing knowledge for the benefit of this world and the hereafter.

The Islamic Religious Education (PAI) curriculum has tended to focus more on normative and ritualistic aspects, while scientific and rational aspects are often marginalized. This creates a gap between religious teachings and the scientific realities faced by students in the digital age. Therefore, a new paradigm is needed in the development of the Islamic Religious Education (PAI) curriculum that is oriented towards the integration of faith and science, so that PAI does not become trapped in the dichotomy of religious knowledge and general knowledge (Azra, 2020). The integration-interconnection approach of Islam and science aims to restore the essence of knowledge as a means of understanding God's verses, both those written in revelation *(the qauliyah verses)* and those spread throughout the universe *(the kauniyah verses).*

Thus, learning science from an Islamic perspective is not merely about understanding natural law, but also about appreciating the greatness of Allah SWT (Fahri, 2016). In the context of strengthening the Islamic Religious Education curriculum, integration and interconnection can be achieved through learning designs that emphasize collaboration between religious and science teachers. For example, when discussing the concept of human creation in the Quran, it can be linked to biology lessons about the human reproductive system. This approach will foster awareness that religious and scientific knowledge are not contradictory, but complementary. Strengthening the Islamic Religious Education (PAI) curriculum based on the integration and

interconnection of Islam and science is also a crucial strategy in shaping the profile of Pancasila students who are faithful, pious, and have noble morals, as mandated by the Independent Curriculum. This integration not only enriches the content of Islamic Religious Education (PAI) learning but also fosters a scientific attitude grounded in spiritual values (RI, 2022). Furthermore, this integrative approach can address the challenges of globalization and secularization, which are increasingly strengthening among the younger generation. The integration of Islam and science will foster epistemological awareness that knowledge is not value-free but has moral and ethical dimensions that must be grounded in divine values.

In the Islamic perspective, knowledge originates from God and is intended for the benefit of humanity. Therefore, science cannot be separated from moral responsibility. The concept of tauhidic epistemology underpins the principle that all forms of knowledge, both religious and scientific, must lead to the recognition of the oneness of God (Wan Daud, 2003). This integration and interconnection also align with the holistic vision of Islamic education, which is to develop human potential holistically: spiritual, intellectual, social, and emotional. An Islamic Religious Education curriculum integrated with science will help students develop a holistic Islamic worldview, enabling them to understand natural and social phenomena within the framework of faith. Efforts to realize this integration and interconnection require a paradigm shift in education among educators. Islamic Religious Education (PAI) teachers need to possess cross-disciplinary insights and be able to interpret Quranic verses contextually within the context of modern scientific developments. This requires training, collaboration between teachers, and support from Islamic higher education institutions.

In its implementation, strengthening the Islamic Religious Education (PAI) curriculum based on integration and interconnection can be achieved through revisions to the Learning Implementation Plan (RPP), development of integrative thematic teaching materials, and the application of project-based learning methods that connect Islamic values with science. For example, environmental observation projects can be linked to the concept of khalifah fil-ardh *(vicegerent)* and human ecological responsibility (Aminah, 2019). An integrated curriculum between Islam and science also plays a crucial role in instilling spiritual and scientific literacy in a balanced manner. Students are not only encouraged to think critically about natural phenomena but also to contemplate the theological meaning behind each of God's creations. This is a form of character education based on transcendental values, much needed in today's era of moral disruption. Institutionally, the integration and interconnection of Islam and science has become mainstream in various Islamic universities in Indonesia, such as UIN *(State Islamic University),* IAIN *(State Islamic Institute),* and STAIN *(State Islamic Institute).* This institutional transformation reflects the awareness of the importance of developing integrative knowledge as a foundation for strengthening the Islamic Religious Education (PAI) curriculum at various levels of education (Aminah, 2023).

METHODS

This research uses a descriptive qualitative approach, which aims to understand phenomena in depth through the interpretation of conceptual and theoretical data. This approach was chosen because the research focuses on analyzing the meaning and concept of the integration and interconnection of Islam and science in the context of strengthening the Islamic Religious Education (PAI) curriculum (Sugiyono, 2011). Descriptive qualitative research emphasizes efforts to understand social reality in a naturalistic way by exploring various perspectives and

relevant sources of information. Therefore, this research is not oriented towards hypothesis testing, but rather towards the systematic exploration of ideas and concepts to discover the deeper meaning contained in related scientific sources.

The type of research used is library research, which is research conducted by reviewing various literature sources such as books, scientific journals, academic articles, seminar results, and official documents related to the theme of the integration of Islam and science in education. Data collection techniques are carried out through identification, classification, and analysis of literature relevant to the research focus. The data obtained are then analyzed using the content analysis method, namely content analysis to find patterns, themes, and relationships between concepts (Zed M., 2004). Through this library study, the researcher seeks to construct a theoretical understanding of how the integration and interconnection of Islam and science can contribute to strengthening the Islamic Religious Education curriculum conceptually and applicatively.

RESULTS AND DISCUSSION

Islamic Religious Education (PAI) has often been viewed separately from general knowledge, particularly science. On the one hand, PAI emphasizes moral, spiritual, and normative aspects, while science focuses more on the empirical and rational. This separation creates a dichotomy between religion and science, influencing students' perspectives on knowledge (Negeri & Barat, 2025). However, from an Islamic perspective, revelation *(the Qur'an and Hadith)* and reason *(reason and observation)* should not operate in separate parallels, but rather complement each other. The concept of monotheism serves as an important philosophical foundation, demonstrating that all of God's creation can be a vehicle for knowledge and understanding leading to the knowledge of God (Mahmudi et al., 2022). The integration referred to is not simply the inclusion of religious elements in science material or vice versa, but rather the establishment of a more systematic relationship between Islamic principles and the scientific method. Thus, a strengthened Islamic Religious Education (PAI) curriculum can simultaneously develop scientific and spiritual understanding.

The urgency of this integration is increasingly felt in the modern era and the era of disruption in science and technology. As science and technology advance rapidly, challenges to values, ethics, and morals also emerge. A strong and integrated Islamic Religious Education (PAI) curriculum can be a tool for instilling Islamic values in the use and development of science. Islamic Religious Education (PAI) plays a central role in shaping the personality of students who are faithful, have noble morals, and are able to think critically about life's phenomena. However, the development of modern science and technology demands a renewed learning paradigm that is not only oriented toward normative-theological aspects but also integrative and interconnected with science. The integration of the interconnectedness of Islam and science in the PAI curriculum is a strategic approach to addressing the challenges of disruption in science, which tends to be secular and separates revelation from reason. This integrative approach stems from the epistemological view of monotheism, which states that all knowledge originates from Allah SWT and is intended for the benefit of humanity.

Therefore, science is not viewed as a neutral, value-free entity, but rather as possessing moral and spiritual dimensions. This integration demands a balance between religious and empirical knowledge, enabling students to discern the order and greatness of God in natural phenomena (Abdullah, 2020). The integration-interconnection paradigm seeks to eliminate the

dichotomy of knowledge and restore all knowledge to a unified whole rooted in the values of monotheism. Within the curriculum, the integration of the interconnection between Islam and science can be implemented through revisions to learning tools such as Lesson Plans (RPPs), the development of thematic-integrative teaching materials, and the application of project-based learning methods. For example, environmental observation activities can be linked to the concept of the caliphate *(khalifah fil-ardh)* and human responsibility in maintaining the balance of nature. This approach not only strengthens scientific literacy but also instills spiritual values and ecological ethics based on the Quran.

Furthermore, implementing an integrative curriculum requires conceptual and methodological understanding from educators. Islamic Religious Education (PAI) teachers need to be equipped with the ability to link Kauniyah verses with modern scientific theories so that students can interpret natural phenomena as signs of God's power (Asri, F., Hadi, S., & Muslehudin, 2024). Scientific approaches to Islamic Religious Education (PAI) learning can be implemented through the development of core competencies (SK-KD), the creation of an interdisciplinary syllabus, and the strengthening of scientific methodology in Islamic analysis. However, challenges such as limited resources, teacher pedagogical skills, and the availability of integrative teaching materials remain implementation barriers that need to be addressed through sustainable education policies. The integration of science and Islam in the curriculum should not only focus on the natural sciences but also involve the social sciences and humanities to create a comprehensive understanding of humans, society, and culture. This is relevant to the spirit of Islam as a religion of rahmatan lil 'alamin *(blessing for the universe),* which regulates human relations with God, others, and nature.

With this integration, the Islamic Religious Education (PAI) curriculum will be more contextual, adaptive, and capable of forming a comprehensive human being who is knowledgeable yet remains rooted in the values of monotheism (Muttaqin, 2024). Furthermore, strengthening the Islamic Religious Education (PAI) curriculum based on the integration of the interconnection of Islam and science can serve as the foundation for character education based on transcendental values. Students are encouraged not only to think critically about natural phenomena but also to contemplate the theological meaning behind each of God's creations. This is an effort to achieve a balance between spiritual and scientific literacy, which is much needed in today's era of moral and technological disruption. Through this integration, Islamic education can play a strategic role in shaping a generation that is faithful, knowledgeable, and has noble morals, while also being able to adapt to developments in science and technology ethically.

A strong Islamic Religious Education (PAI) curriculum should encompass a vision of monotheism that is not merely theoretical but serves as a framework for thinking; that all knowledge, both religious and scientific, ultimately leads to the recognition, advancement, and devotion to Allah SWT. The Islamic Religious Education (PAI) curriculum needs to be designed in a holistic and interconnected manner: not only adding scientific elements to religious studies but also creating real connections between scientific phenomena and revelation, between technology and Islamic ethics, between nature and spirituality (Nurhadi, 2021). The development of Islamic Religious Education (PAI) materials must incorporate learning practices such as contemplation *(tafakkur),* reflection *(tadabbur),* scientific experiments, and environment-based projects, which encourage students not only to listen but also to see, reflect, and act. Evaluation of the Islamic Religious Education (PAI) curriculum needs to encompass cognitive, affective, and spiritual dimensions; indicators of faith, environmental sensitivity, scientific ethics, and Islamic

character must be part of the assessment of the curriculum's success. Strengthening the Islamic Religious Education (PAI) curriculum through the integration of the interconnectedness of Islam and science is not only an academic transformation but also an epistemological reconstruction of the human perspective on knowledge. This curriculum is expected to restore the function of knowledge as a means of knowing Allah, while optimizing human potential as a caliph on earth who brings blessings to the universe.

The integration of Islam and science demands an epistemological shift in the Islamic Religious Education curriculum from a dichotomous model *(religion vs science)* to a transdisciplinary model that recognizes both scientific reasoning and theological insight; this opens up space for students to understand revelation and empiricism as two complementary realms of knowledge. Practically, the Islamic Religious Education (PAI) curriculum, which integrates science, needs to be restructured: core competencies and learning outcome standards must incorporate indicators of scientific literacy *(e.g., critical thinking, scientific methods)* alongside religious competencies *(understanding teachings, morals).* The latest PAI curriculum document has begun to include the topic "Integrating Islam with Science" as a topic of study, reinforcing this revised direction (Febriyani & Anwar, 2025). The implementation of an integrated curriculum influences the design of syllabi and teaching materials: science topics *(e.g., ecology, biotechnology, technological ethics)* need to be linked to Islamic values *(khalifah, tawazun, amanah)* so that learning provides both normative meaning and factual knowledge.

There are strong implications for teacher training: Islamic Religious Education (PAI) teachers must be equipped with basic scientific skills and scientific literacy, while science teachers need to be sensitive to religious values so that material is not presented in a value vacuum. Research-based curriculum management models have demonstrated effectiveness when teachers are trained in integrated material development and interdisciplinary methods (Aliyah et al., 2024). Learning methods are changing more use of cross-subject projects, problem-based approaches (PBL), and field explorations that link natural phenomena to verses, hadith, and scientific ethics; this increases the relevance of learning for students. From an assessment perspective, integration requires diverse assessment formats: in addition to cognitive tests, portfolio assignments, scientific projects with religious values, and attitude character assessments that measure the internalization of values *(e.g., environmental responsibility)* are needed. Formative assessments and clear rubrics are essential for measuring multiple competencies. At the textbook and learning resource level, the implication is the need for valid, integrated teaching materials presenting both accurate scientific examples and responsible religious interpretations. Many local studies and monographs have begun producing integrative textbooks in response to this need.

Curriculum development needs to consider the philosophical foundations of Islam *(tawhid, khalifah, amanah)* as a framework that provides normative direction for the use of knowledge for example, distinguishing between ethical and risky technological advances. This is crucial to prevent integration from becoming an excuse for technological legitimacy without moral oversight. Policy implications: Ministries and curriculum stakeholders must provide an integration framework, implementation guidelines in schools madrasas, and administrative support *(e.g., lesson hours, budget allocation, training modules).* Without regulation and structural support, teacher initiatives will be hampered. The connection to contemporary issues such as the climate crisis, bioethics, and AI makes Islam-science integration a curricular tool for preparing ethical and competent citizens to face global challenges; an integrative Islamic Religious Education curriculum can embed an ethical perspective based on religious values in modern

scientific discourse. At the madrasah pesantren level, integration opens up opportunities for collaboration between programs *(e.g., pesantren science programs, integrated laboratories)* that strengthen the relevance of religious education to 21st-century skills. Recent studies have noted the development of transdisciplinary approaches in Islamic boarding school environments (Irsyad, 2019).

Resource implications: Schools need access to simple laboratories, digital teaching materials, and libraries that cover contemporary science and Islamic studies literature. The gap in facilities between urban and rural schools needs to be addressed to prevent integration from widening inequalities. From a gender equity and inclusion perspective, an integrative curriculum must be sensitive to access for all groups *(boys, girls, people with disabilities)* e.g., ensuring field activities, experiments, and project assignments are accessible and culturally relevant. Implications for educational research: A research agenda that tests integrative learning models *(effectiveness on cognitive, affective, and psychomotor outcomes),* longitudinal studies on the impact on character, and the development of new assessment instruments is needed. Several recent studies recommend classroom action research protocols to adapt models to local contexts (Aliyah et al., 2024). Integration carries ethical implications: the curriculum must emphasize the precautionary principle in teaching new technologies for example, critical discussions of GMOs, gene editing, and AI so that students learn to weigh the benefits and risks based on Islamic values.

At the professorial and curriculum development level in universities, there are calls for a reorientation of religious education study programs to include courses in the philosophy of science, scientific methodology for religious educators, and interdisciplinary practice this supports the regeneration of educators capable of operationalizing integration. Financial implications: Sustained investment is needed in developing teacher capabilities, teaching materials, practical facilities, and curricular research. Partnership models *(school university industry)* can provide solutions for financing and access to technical resources. Community involvement *(parents, religious leaders, local scientists)* is key: successful integration usually involves multi stakeholder dialogue to prevent the material from eroding traditional authority and to ensure community values are considered in shaping the learning context. A risk that must be anticipated: if not carefully managed, integration could become simply "gluing" science topics onto religious studies without epistemic authentication leading to conceptual confusion. Therefore, the need for theoretical guidance and credible sources is crucial. Brief practical recommendations: (a) develop an integrated PAI Science competency framework; (b) design cross disciplinary teacher training; (c) develop new assessment modules and rubrics; (d) facilitate classroom action research; (e) provide policy and funding support; (f) engage local stakeholders. With these steps, the PAI curriculum will not only strengthen faith but also prepare students to become ethical and critical scientific citizens.

The first limitation is the limited scope and sample size. Many studies of Islam-science integration are still library or case studies in one or a few madrasas schools, thus limiting the generalizability of the results to national or cross-regional contexts. Therefore, practical findings *(e.g., regarding the effectiveness of learning models)* are often only valid within the context studied (Chanifudin & Nuriyati, 2020). Methodological limitations: reliance on descriptive and cross-sectional designs. Without longitudinal data or controlled experiments, it is difficult to assess the long-term impact of integration on students' science competencies, spirituality, and character. Many researchers recommend ongoing pilot interventions to measure changes in competencies and internalization of values. Limitations related to teacher competency and institutional

readiness. Implementing an interconnected curriculum requires Islamic Religious Education (PAI) teachers who understand scientific aspects and science teachers who are sensitive to Islamic values; however, research has found gaps in skills, training, and inadequate professional support. Without training and professional development models, the implementation of integration will be limited (Ahmad, 2024).

Limitations of assessment instruments: the lack of integrated measurement tools to measure both cognitive and value affective outcomes. Many studies still use traditional instruments for a single domain *(e.g., science tests or religiosity scales),* thus failing to capture the breadth of integrated outcomes. Developing valid and reliable instruments is a critical need (Chanifudin & Nuriyati, 2020). Policy and system limitations: the gap between central curriculum policies and practice. Curriculum reforms often allow for integrated theory, but implementation requires operational guidelines, integrated teaching materials, and supporting national assessments all of which are not always available. Therefore, studies that only examine curriculum design without analyzing practical policies provide an incomplete picture (Habibi et al., 2024). Technology and access limitations: Inequality in access to technology and digital learning resources limits the implementation of integrative models that utilize simulations, multimedia, or research-based resources. Research shows differences in digital readiness across schools madrasas, which impact the success of science and Islam integration, particularly in the Society 5.0 era. This limits the generalizability of high tech recommendations (Salsabila et al., 2024).

Recommendation expand the scope and design of research: conduct multisite studies *(urban rural, madrasah state school)* and use mixed methods designs as well as longitudinal or quasi experimental studies to test the causal effects of the integration model on science achievement and value internalization. Multisite studies will test the transferability of the model across cultural and resource contexts (Juni Mahanis & Nunung Witono, 2025). Recommendation develop and validate an integrated assessment instrument that measures cognitive *(scientific literacy),* affective *(Islamic values ethics),* and psychomotor *(scientific skills)* domains. Practical recommendation: an interdisciplinary research team *(Islamic education, educational science, psychometrics)* should develop a pilot assessment package, test its reliability validity, and then implement it at various levels for standardization (Chanifudin & Nuriyati, 2020). Recommendation Teacher interventions and continuing professional development: Design action research for Islamic Education Science teacher training programs that focus on integrative pedagogical strategies, teaching materials development, and mentoring. Evaluation of these training programs should measure transfer to practice *(whether teachers actually change their teaching practices)* and their impact on student learning. Additionally, engage policymakers to facilitate wider adoption. Recommendation Comparative policy studies and international collaboration: Conduct comparative studies between integration models in different countries regions *(e.g., Islamic boarding schools madrasahs in Indonesia vs. Islamic schools in other countries)* to identify best practices. Encourage research involving stakeholders *(ministries of education, religious institutions, schools, parents*) and test implementation on specific local curricula to make policy recommendations more applicable and context sensitive (Jalil et al., 2025)

CONCLUSION

Based on the literature review and research findings, it is recommended that the Islamic Religious Education (PAI) curriculum be strengthened through an integrated approach the interconnection between Islamic values and scientific concepts. This integration not only enriches students' understanding of science but also fosters spiritual and ethical awareness in every scientific activity. This can be implemented through revisions to lesson plans (RPP), the development of integrative thematic teaching materials, and project based learning methods that link natural phenomena to Islamic principles, such as the concept of khalifah fil-ardh *(vicegerent)* and social responsibility. Thus, an interdisciplinary, integrated PAI curriculum will equip students with a balance of scientific and religious literacy, while simultaneously preparing them to face the moral and intellectual challenges of the modern era.

Furthermore, strengthening the Islamic Religious Education (PAI) curriculum through the integration of Islam and science requires support from teacher competency enhancement and the provision of relevant learning resources. Teachers act as facilitators, capable of connecting scientific concepts with Islamic values creatively and contextually. Support in the form of training, teaching modules, and interactive learning media will strengthen the effectiveness of this integration. Thus, this interconnected approach emphasizes not only the transfer of knowledge but also the development of character, morals, and critical awareness in students, thereby making Islamic education in schools more relevant to the needs of today's generation. Therefore, the interconnections between Islam and science are not only pedagogical strategies but also epistemological and ideological projects for building a superior Islamic civilization in the modern era. An integrated Islamic Religious Education (PAI) curriculum will produce a generation that is religious, scientific, and has a strong personality, ready to face the currents of globalization.

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