



Curriculum Harmonization in the Pedagogical Framework of UIN K.H. Abdurrahman Wahid Pekalongan

Mohammad Syaifuddin¹, Salafudin², Arditya Prayogi³, Norma Alias⁴

^{1,2,3}Universitas Islam Negeri K.H. Abdurrahman Wahid Pekalongan, Indonesia

⁴Universiti Teknologi Malaysia

ABSTRACT

The effectiveness of a curriculum depends on its alignment with a coherent scientific philosophy that reflects real conditions. This study examines the application of the philosophy of scientific harmonization in the curriculum structure of K.H. Abdurrahman Wahid State Islamic University (UIN) Pekalongan. Using a qualitative field research approach, data were collected from university leadership, lecturers, and the institutional transition team, alongside supporting documentation. Analysis employed an interactive model of data reduction, presentation, and verification. Findings indicate that UIN Pekalongan deliberately adopted the philosophy of scientific harmonization to overcome the dichotomy between religious and general sciences. This approach avoids both extreme theocentric and anthropocentric orientations, promoting instead a balanced integration framed as the “Arc of Scientific Harmonization” or “Scientific Orchestra,” with Tauhid serving as its unifying foundation. The curriculum structure reflects this principle by allocating 44% of credits to general sciences and 36% to religious sciences, achieving an overall integration rate of 17%. While this model successfully balances religious and general knowledge, a significant limitation is the minimal inclusion of technology-related courses, which account for only 3% of the curriculum. This gap poses challenges for institutional competitiveness in the context of the Fourth Industrial Revolution. The study concludes that UIN Pekalongan has made important strides in implementing a harmonized curriculum model, yet greater emphasis on technological content is needed to ensure its sustainability and relevance in the digital era.

ABSTRAK

Secara teoritis, fungsi kurikulum dapat tercapai dengan baik dengan memiliki filsafat keilmuan yang juga tepat mengingat implementasi kurikulum yang akan diterima harus sesuai dengan kondisi riil. Penelitian ini menganalisis apa dan bagaimana filsafat keilmuan harmonisasi ilmu diterapkan dalam struktur kurikulum di Universitas Islam Negeri K.H. Abdurrahman Wahid Pekalongan berupa merumuskan model struktur kurikulum di kampus yang mencerminkan harmonisasi keilmuan. Jenis penelitian ini adalah penelitian lapangan dengan pendekatan kualitatif. Sumber data utama diperoleh dari pimpinan UIN K.H. Abdurrahman Wahid Pekalongan dan dosen beserta tim alih status IAIN menjadi UIN. Sumber data sekunder diperoleh dari dokumen-dokumen tertulis yang terkait dengan IAIN Pekalongan. Sementara itu, analisis data dalam penelitian ini menggunakan metode interaktif, yaitu reduksi data, penyajian dan verifikasi. Hasil penelitian ini menunjukkan bahwa UIN K.H. Abdurrahman Wahid Pekalongan memilih filosofi harmonisasi keilmuan untuk menghindari konflik dan independensi ilmu pengetahuan, yang bersifat dikotomi di mana corak konsep-konsep keilmuan tidak bersifat teosentris ekstrem maupun antroposentris ekstrem, melainkan memiliki corak harmonisasi di antara keduanya. Konsep harmonisasi keilmuan di UIN K.H. Abdurrahman Wahid

OPEN ACCESS

ARTICLE HISTORY

Received: 06-02-2025

Accepted: 31-08-2025

KEYWORDS

Scientific Philosophy, Curriculum Integration, Religious Education, Harmonization of Knowledge, Islamic Education

KATA KUNCI

Filsafat ilmu, Integrasi Kurikulum, Pendidikan Agama, Harmonisasi Ilmu Pengetahuan, Pendidikan Islam

Pekalongan digambarkan sebagai "Busur Harmonisasi Keilmuan" yang menggambarkan sebuah "Orkestra Ilmiah", yang menekankan Tauhid sebagai landasan utama harmonisasi ilmu pengetahuan. Kajian ini mengungkapkan bahwa kurikulum UIN K.H. Abdurrahman Wahid Pekalongan berhasil menyeimbangkan ilmu pengetahuan umum dan ilmu pengetahuan agama, dengan tingkat integrasi sebesar 17%, tetapi kurang memadai dalam muatan terkait teknologi. Lebih lanjut, dalam struktur kurikulum di UIN K.H. Abdurrahman Wahid Pekalongan telah menunjukkan penerapan harmonisasi keilmuan melalui penyediaan mata kuliah di setiap program studi secara berimbang, dilihat dari jumlah SKS (bobot keilmuan), yaitu antara ilmu umum dan ilmu agama dengan rasio 44%:36%. Namun, penyediaan mata kuliah terkait pemanfaatan teknologi hanya 3%, yang merupakan kelemahan karena teknologi telah menjadi hal penting di era revolusi industri 4.0.

Introduction

On June 8, 2022, through Presidential Decree Number 86 of 2022, IAIN Pekalongan was officially transformed into the State Islamic University (UIN) K.H. Abdurrahman Wahid (RI, 2022). This institution is the only State Islamic Religious College as well as a State University located in the former Pekalongan Residency area. Since its founding in 1968, UIN K.H. Abdurrahman Wahid Pekalongan has devoted more than 52 years to the mission of educating the nation and playing an active role in development and community service (Sejarah, n.d.). Given its more than half-century of service, the change of institutional form was a timely step to ensure renewal and progress.

The transformation into UIN K.H. Abdurrahman Wahid is supported by the need for a strong scientific foundation and philosophical orientation. This foundation relates to improving the quality of science in a more integrative and transformative manner, preparing a generation that is strong in *imtak* (faith and piety) while also competent in science and technology. To realize this vision, UIN K.H. Abdurrahman Wahid Pekalongan adopted the scientific philosophy of "Harmonization of Science" (Rumuskan Visi Keilmuan UIN, IAIN Pekalongan Gelar FGD, n.d.). This philosophy integrates religious and general sciences within the curriculum, ensuring a balanced approach. For example, Islamic Family Law (HKI) combines sharia with contemporary legal studies, while Islamic Religious Education (PAI) incorporates modern pedagogical approaches (Adiyono et al., 2024). Such integration equips graduates with both spiritual and professional competencies, enabling them to face modern challenges (Manshuruddin et al., 2025; Riwanda et al., 2024).

Addressing the dichotomy between religious and general sciences remains a central challenge in Islamic higher education. This dichotomy often leaves graduates insufficiently prepared for the complexities of modern society, particularly in the context of Industry 4.0. Globally, higher education institutions face similar challenges in balancing specialization with interdisciplinary competence (Nawas et al., 2025), underscoring the importance of innovative curriculum models (Singun, 2025; Zuo et al., 2025). By implementing scientific harmonization, UIN K.H. Abdurrahman Wahid Pekalongan seeks to bridge this gap, producing graduates who embody both spiritual depth and scientific capability.

The philosophy of scientific harmonization also aligns with the concept of moderation (*wasatiyyah*), which emphasizes balance and mediation. Moderation, often understood as avoiding extremes, originates from Islamic epistemology and functions as a mediator between opposing tendencies. Thus, harmonization of science mediates the discourse between religion and science. This model arose as a response to secular paradigms that separated religion from worldly affairs, leading to the neglect of science in the Islamic world and contributing to civilizational decline. At PTKIN, including at UIN

and IAIN, this legacy created an academic focus on religious knowledge while sidelining general sciences.

Consequently, *qauliyah* sciences (derived from revelation) and *kauniyah* sciences (derived from empirical observation) have been separated in the Islamic academic tradition. This separation has limited the capacity of PTKIN graduates to address public issues and contribute effectively to national development in the era of the industrial revolution 4.0. The transformation from IAIN to UIN therefore requires expanding the mandate of scientific studies, from a narrow focus on religion to the inclusion of general sciences that support religious knowledge. This expansion is grounded in a strong philosophical basis and aims to foster integrative scholarship.

This study addresses an important gap in the literature by examining how UIN K.H. Abdurrahman Wahid Pekalongan operationalizes its scientific harmonization philosophy through curriculum design. While UIN Walisongo Semarang advanced the paradigm of Unity of Sciences (Adinugraha et al., 2018) and UIN Sultan Maulana Hasanuddin Banten adopted the integration-comparative-diffusion paradigm (Muzhiat & Kartanegara, 2020), both approaches remain primarily conceptual. Research by Rifai et al. (2014) also confirms that UINs across Indonesia share a general commitment to integration, though differences exist in terminology. However, these studies provide limited insights into practical curriculum structures.

This research advances existing knowledge by analyzing how harmonization of science is concretely implemented in UIN K.H. Abdurrahman Wahid Pekalongan's curriculum. By examining the balance of credit allocations across religious, general, and integrative sciences, it reveals a distinctive model that emphasizes Tauhid as its ontological foundation (Hadi et al., 2024; Hanif et al., 2025). Unlike previous studies, which focus mainly on theoretical paradigms, this research highlights practical curriculum design as a replicable model for other Islamic institutions. In doing so, it contributes both theoretically—by articulating harmonization as a unique philosophical approach—and practically, by offering a scalable framework for interdisciplinary education rooted in moderation (Mariyono, 2024; Mukhibat et al., 2024).

Method

This study was designed as field research employing a qualitative approach (Sugiyono, 2005). The research was conducted in two main stages. The first stage aimed to explore and explain the existing curriculum structures at UIN K.H. Abdurrahman Wahid Pekalongan. The second stage formulated a model of scientific harmonization within the curriculum, grounded in existing theories of scientific integration. Primary and secondary data sources were identified to support these stages.

The qualitative field research approach was selected because it provides in-depth insights into the complex and context-specific process of curriculum development. By employing interviews with university leadership and lecturers involved in the institutional transition from IAIN to UIN, along with document analysis of curriculum structures and academic profiles, this study was able to capture nuanced perspectives and lived experiences that quantitative approaches might overlook. Such methods were particularly appropriate for examining both the philosophical and practical dimensions of scientific harmonization, allowing for a detailed understanding of how curriculum decisions embody the integration of religious and general sciences (Lim, 2025). The use of interactive data analysis techniques further ensured a comprehensive and contextually grounded interpretation of findings.

The primary data consisted of information from two main sources: (1) university management and leadership (Sudaryono, 2016) and (2) lecturers and transition teams

directly involved in the institutional change. Secondary data were drawn from documents on university profiles, academic activities, student programs, and curriculum structures (Albi Anggito, 2018), as well as journals, theses, books, websites, and other scholarly literature on the integration and harmonization of science in higher education (Hermawan, 2019).

A purposive sampling technique was applied to select informants based on their position, competence, and expertise relevant to the research focus (Rosyada, 2020). The key informants included university leaders and lecturers serving on the institutional transition team. Data were collected through interviews, observations, and documentation (Suwendra, 2018). To ensure credibility, data validation employed triangulation of sources, observers, and theories (Endang, 2018). Data analysis followed the interactive model popularized by Miles and Huberman, involving reduction, presentation, and verification (Yusuf, 2015).

Results and Discussion

Results

Structure of the Harmonized Science Curriculum at UIN K.H. Abdurrahman Wahid Pekalongan

The curriculum is a vital instrument and tool for achieving educational goals so that the educational process in the form of teaching and learning activities becomes orderly and focused. The curriculum can also be interpreted as a set of subject matter/content with various learning experiences delivered by educators to students through a special plan in order to achieve certain educational goals (Syaifuddin, 2021). The curriculum will continue to develop following developments in time and society. This means that the development of a curriculum is carried out dynamically and continuously towards perfection. The curriculum principles at least follow the rules; relevance, effectiveness, efficiency, sustainability, flexibility, goal-oriented and development model principles. Curriculum changes in higher education are routine activities that must be carried out in response to developments in science and technology (IPTEK) (scientific vision), societal needs, as well as the needs of graduate users (stakeholder needs). These changes also occurred at UIN K.H. Abdurrahman Wahid Pekalongan after transferring status from IAIN Pekalongan.

Below the researchers present the scientific percentages in each faculty at UIN K.H. Abdurrahman Wahid Pekalongan, the researcher analyzed based on the curriculum structure in each study program. The structure of the study program curriculum is in the form of a list of course names adapted to the CPL and the characteristics of each study program. The form of scientific percentage in the curriculum structure component is a list of courses analyzed by researchers based on elements of religious science, general science, technology and courses that have experienced integration of religious and general science.

Curriculum Structure at the Sharia Faculty

The composition of the curriculum structure at the Faculty of Sharia is based on the composition of the curriculum structure of the three study programs it manages, namely: 1) Islamic Family Law (HKI), 2) Sharia Economic Law (HES), and 3) Constitutional Law (HTN). Based on the results of data analysis on the distribution of courses in the three Sharia Faculty study programs, it was found that the percentage of curriculum structure in the Sharia Faculty was as follows in the following diagram 1.

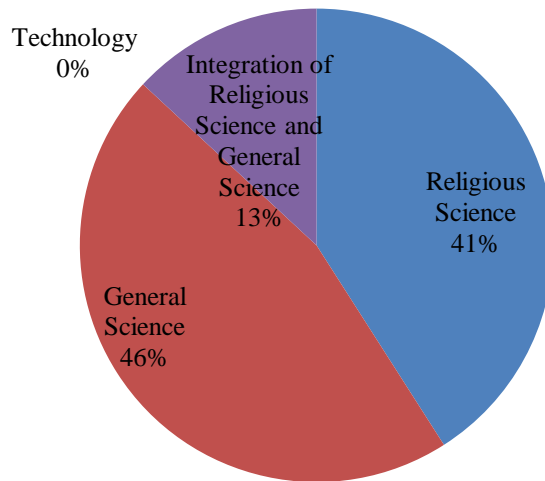


Diagram 1. Percentage of Sharia Faculty Curriculum Structure

Based on the diagram 1, the curriculum structure at the Sharia Faculty shows that this faculty has implemented scientific harmonization by offering courses in each study program with a balanced number of credits (scientific weight) between general science and religious science with a ratio of 46%: 41%. The Sharia Faculty has also been able to offer integrative courses between general science and religion at 13%. However, the Sharia Faculty has not been able to offer courses related to the use of technology because technological skills for students are really needed in this era of industrial revolution 4.0.

Curriculum Structure at the Faculty of Tarbiyah and Teacher Training

The composition of the curriculum structure at the Faculty of Tarbiyah and Teacher Training is based on the composition of the curriculum structure of the six study programs it manages, namely: 1) Islamic Religious Education (PAI), 2) Arabic Language Education (PBA), 3) Madrasah Ibtidaiyah Teacher Education (PGMI), 4) Early Childhood Islamic Education (PIAUD), 5) Mathematics Tadris (T.Mat) and 6) English Tadris (TBIG). Based on the results of data analysis on the distribution of courses in the six study programs of the Tarbiyah and Teacher Training Faculty, the results of the percentage of curriculum structure in the Tarbiyah and Teacher Training Faculty are as shown in the following diagram 2.

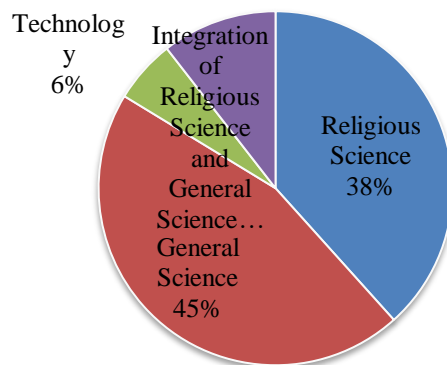


Diagram 2. Percentage of Curriculum Structure for the Faculty of Tarbiyah and Teacher Training

Based on the diagram 2, the curriculum structure at the Faculty of Tarbiyah and Teacher Training shows that this faculty has implemented scientific harmonization through offering courses in each study program with a balanced number of credits (scientific weight) between general science and religious science with a ratio of 45%: 38% . The Faculty of Tarbiyah and Teacher Training also offers integrative courses between general science and religion at 11%. Apart from that, the Faculty of Tarbiyah and Teacher Training also offers courses related to the use of technology at 6%.

Curriculum Structure at the Faculty of Ushuludin, Adab and Da'wah

The composition of the curriculum structure at the Faculty of Ushuludin, Adab and Da'wah is based on the composition of the curriculum structure of the six study programs it manages, namely: 1) Al-Qur'an and Tafsir Science (IAT), 2) Hadith Science (IH), 3) Sufism and Psychotherapy (TP), 4) Islamic Extension Guidance (BPI), 5) Islamic Communication and Broadcasting (KPI), 6) Da'wah Management (MD). Based on the results of data analysis on the distribution of courses in the six study programs of the Faculty of Ushuludin, Adab and Da'wah, the results of the percentage structure of the curriculum in this Faculty are as shown in the following diagram 3.

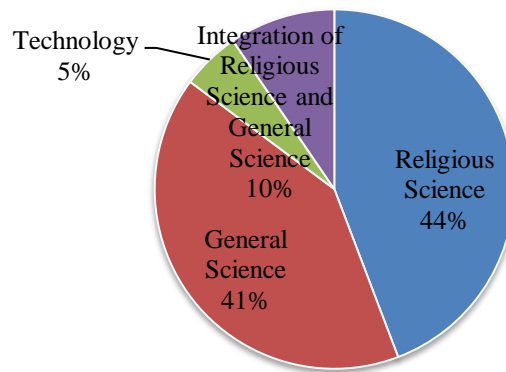


Diagram 3. Percentage of Ushuludin, Adab and Da'wah Faculty Curriculum Structure

Based on the diagram 3, the curriculum structure of the Faculty of Ushuludin, Adab and Da'wah shows that this faculty has implemented scientific harmonization by offering courses in each study program with a balanced number of credits (scientific weight) between general science and religious science with a ratio of 41% : 44% . The Faculty of Ushuludin, Adab and Da'wah also offers 10% integrative courses between general science and religion. Apart from that, the Faculty of Ushuludin, Adab and Da'wah also offers courses related to the use of technology at 5%.

Curriculum Structure at the Faculty of Islamic Economics and Business

The composition of the curriculum structure at the Faculty of Islamic Economics and Business is based on the composition of the curriculum structure of the three study programs it manages, namely: 1) Sharia Economics (Ekosy), 2) Sharia Banking (PS), 3) Sharia Accounting (Aksya). Based on the results of data analysis on the distribution of courses in the three study programs of the Faculty of Islamic Economics and Business, the percentage results of the curriculum structure in this Faculty were found as shown in the following diagram 4.

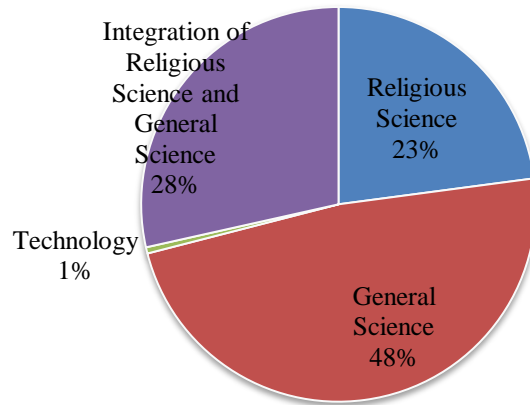


Diagram 4. Percentage of Curriculum Structure of the Faculty of Islamic Economics and Business

Based on the diagram 4, the curriculum structure of the Faculty of Islamic Economics and Business shows that the faculty has implemented scientific harmonization through offering courses in each study program with a less balanced number of credits (scientific weight) between general science and religious science with a ratio of 48%: 23%. However, the Faculty of Islamic Economics and Business already offers integrative courses between general science and religion at 28%. This faculty offers courses related to the use of technology which is very small, namely 1%.

Curriculum Structure in Postgraduate Studies

The composition of the curriculum structure at the Postgraduate Program at UIN K.H. Abdurrahman Wahid Pekalongan based on the composition of the curriculum structure of the five study programs he manages, namely: 1) Masters in Family Law (MHK), 2) Masters in Islamic Religious Education (MPAI), 3) Masters in Sharia Economics (MES), 4) Masters in Madrasah Teacher Education Ibtidaiyah (MPGMI), 5) Master of Arabic Language Education (MPBA). Based on the results of data analysis on the distribution of courses in five postgraduate study programs at UIN K.H. Abdurrahman Wahid Pekalongan found the percentage results of the curriculum structure as shown in the following diagram 5.

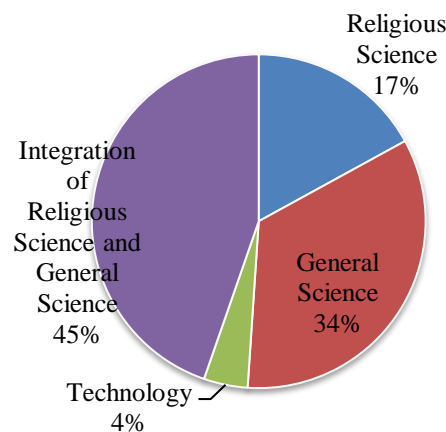


Diagram 5. Percentage of Postgraduate Curriculum Structure

Based on the diagram 5, the curriculum structure at Postgraduate shows that Postgraduate has implemented scientific harmonization through offering courses in each study program with a fairly balanced number of credits (scientific weight) between general science and religious science with a ratio of 34%: 17%. However, postgraduate courses already offer integrative courses between general science and religion at 45%. Apart from that, Postgraduate also offers courses related to the use of technology at 4%.

Based on the data, it can be concluded that the percentage of the scientific structure of the curriculum in the four Faculties and Postgraduate Programs of UIN K.H. Abdurrahman Wahid Pekalongan through the distribution of courses in each existing Study Program through the following diagram 6.

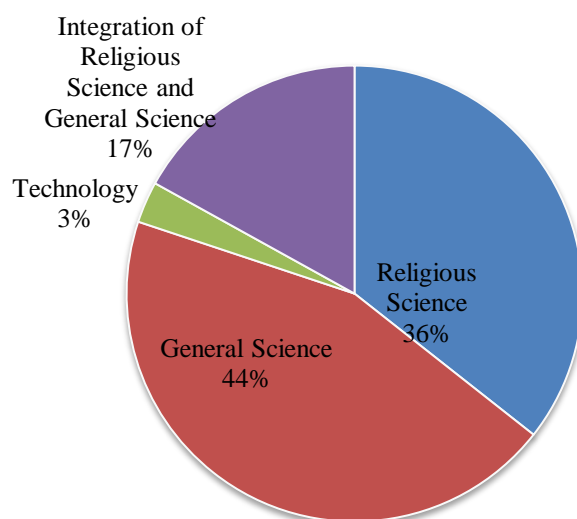


Diagram 6. Percentage of UIN K.H. Curriculum Structure Abdurrahman Wahid Pekalongan

Based on Diagram 6, the curriculum structure at UIN K.H. Abdurrahman Wahid Pekalongan showed that this campus has implemented scientific harmonization by offering courses in each study program with a balanced number of credits (scientific weight) between general science and religious science, with a ratio of 44%: 36%. Apart from that, several study programs already offer integrative courses between general science and religion at 17%. However, it is very unfortunate that the offer of courses related to the use of technology is only 3% even though technology skills for students are really needed in this era of industrial revolution 4.0.

Discussion

The Significance of the Philosophy of Scientific Harmonization at UIN K.H. Abdurrahman Wahid Pekalongan

According to Ian G. Barbour, the relationship between religion and science is classified into four types, namely, conflict, independence, dialogue and integration (Jendri, 2019). Practices in Islamic educational institutions generally still use the paradigm of conflict and independence. Both those who use the conflict paradigm and/or independence have a big influence on the formation of a culture of socio-religious thinking both in the private and public spheres. The argument to be put forward is that the relationship between religion, in this case *ulumu al-din* and general sciences, such as natural, social and cultural sciences necessitates a dialogical, integrative-interconnective nature of the relationship.

The development of knowledge in Islamic educational institutions still seems to be characterized by conflict and independence, which is dichotomy in nature. There are many factors that cause these sciences to be dichotomous or disharmonious, including differences at the ontological, epistemological and axiological levels of the two fields of science. As is known, Islamic religious knowledge starts from revelation which is absolutely true and is assisted by reasoning which in the process of its use must not conflict with revelation (revealed knowledge). Meanwhile, the general science that exists so far comes from the West and is based on atheistic, materialistic, secularistic, empiricistic, rationalistic and even hedonistic philosophical views. The two things that form the basis of these two fields of science are clearly very different, and difficult to reconcile. This condition is one of the main factors causing the withering away of Islamic intellectualism in Islamic education circles.

Now, it is time for there to be no dichotomy between revelation and nature, as Ibn Taimiyyah believes that there is no conflict between rationality and revelation. The Prophet Muhammad SAW taught his people not to follow blind faith, namely to imitate the traditions of their ancestors without using critical thinking. Islam teaches that defending one's mind, property, family, dignity, honor, life and religion is a must for every individual. So it would be better if revelation and reason should not be conflicted in Islam (Triyono, 2021).

To minimize dichotomy, efforts are needed in the form of knowledge integration. Integration comes from the English language Integrate, Integration which was absorbed into Indonesian to become integration which means to combine, combine (John M. Echlos, 2003). Integration can also be interpreted as mixing, combining, uniting to become a complete unit. Along the way, thinking about the integration of knowledge between several Islamic figures throughout the world experienced various paradigm differences starting from terminology, models and procedures (Muhlisin, 2020).

To overcome the problem of dichotomy and the incomplete integration process, other efforts are needed in the form of harmonizing the two as something important, because denying religion in the development of science and technology will have an ongoing negative impact. The problem of the dichotomy of knowledge does not make a positive contribution to the sustainability of Islamic civilization, on the contrary it adds to the problems in the Islamic world when faced with secular western civilization. To connect the compound of knowledge that was once divided into extreme west-east poles, Islamic educational institutions need to open up with efforts to harmonize knowledge in Islamic educational institutions, including UIN K.H. Abdurrahman Wahid Pekalongan who is part of the Ministry of Religion. The science style of UIN K.H. Abdurrahman Wahid Pekalongan has been based on the big idea of moderation by not taking extreme attitudes, whether extreme theocentric or extreme anthropocentric but has a distinctive style of harmonization between the two, a style of science resulting from joint synergy between various kinds of science and Islamic religious knowledge.

Apart from that, normatively the Qur'an explains the position of Muslims as mediators who balance the religious attitudes of Jews and Christians. The essence of Islamic teachings itself actually reflects "moderation" in all its teachings. For example, in the aspect of faith; Islamic teachings act as a mediator (*washith*) between the beliefs of polytheists who are subject to khurafat and myth, and the beliefs of a group of people who deny everything that is metaphysical. In this case, Islamic teachings are a balance, because apart from humans believing in the supernatural, they also invite the human mind to prove its teachings rationally. This proves that Islamic teachings can mediate and are relevant to human nature.

The balance (moderation) between the practice of knowledge, both for the benefit of this world and the hereafter, has been outlined by Allah in the Al-Qur'an, precisely in

Surah Al-Qashash verse 77. In this verse, Allah SWT provides guidance to Muslims to implement moderation in three ways main message (Syaifuddin & Taufiq, 2023). First, balancing preparations for worship towards happiness in the afterlife with obtaining worldly pleasures based on Allah's pleasure; secondly, balancing goodness in the form of blessings that Allah has given with efforts to repay Allah's blessings by doing good towards fellow humans; thirdly, balancing God's creation and maintenance of the universe with the prohibition against causing damage to the earth. Apart from Surah Al-Qashash verse 77, several other verses in the Qur'an can actually be understood to mean that Islamic teachings are universal (*rahmatan lil'alamin*) and balanced/moderate (*washathiyah*) which teaches its people to think, behave and interactions that are based on a *tawazun* (balanced) attitude and do not conflict with common sense and human nature (Mohammad Syaifuddin, Siti Sa'adah, Reza Hidayat, 2024).

The balanced curriculum structure at UIN K.H. Abdurrahman Wahid Pekalongan, has demonstrably enhanced student engagement by fostering critical thinking and interdisciplinary competence. For instance, students in the Faculty of Sharia, exposed to integrative courses like Islamic Family Law combined with contemporary legal studies, report higher motivation and analytical skills, as evidenced by improved academic performance in capstone projects compared to peers in institutions with less integrated curricula. This harmonized approach also contributes to societal impacts by producing graduates who can address complex social issues (Viera Trevisan et al., 2024), such as ethical dilemmas in technology, with a balanced perspective rooted in both religious and scientific knowledge (Suneki et al., 2023). In contrast to UIN Walisongo Semarang, where integration focuses more on theoretical paradigms, UIN K.H. Abdurrahman Wahid Pekalongan's practical curriculum application fosters measurable outcomes, including higher graduate employability in diverse sectors, aligning with the demands of the Industry.

Thus, Harmonization of Knowledge is Sunnatullah, because all potential ecosystems on earth are processed according to their respective roles without any aspect being the most prominent. Harmonization of knowledge as a gift from Allah, its existence is very important in human life, because it can increase devotion and the status of believers. Through the harmonization of knowledge, it will bring benefits to human civilization, with the diversity of knowledge on earth, people with diverse backgrounds can experience peace and benefits continuously. Harmonization of science supports Islamic civilization, where harmonization of science positions itself as a form of seriousness, continuity with full commitment to obtain maximum results without separating religion and science, as harmonization of science is one of the building blocks of moderation itself in the form of balance and synergy between Islamic religious traditions, santifik and technological processes (Syaifuddin, 2022).

Harmonization of knowledge proves that humans have weaknesses in each other, but also have strengths that can strengthen each other. All types and scopes of knowledge certainly come from one source, namely Allah SWT. Therefore, science does not recognize dichotomy, the diversity of knowledge proves the greatness of God and positions humans as limited servants. Thus, knowledge comes from Allah and must be used for the benefit of humanity.

The curriculum structure at UIN K.H. Abdurrahman Wahid Pekalongan represents a novel contribution through its scientific harmonization approach, uniquely balancing general and religious sciences at a 44%:36% ratio while incorporating 17% integrative courses, a model distinct from the predominantly theoretical integration frameworks observed in other Islamic universities, such as UIN Walisongo Semarang. This practical implementation, grounded in the "Arc of Scientific Harmonization" and emphasizing Tauhid as the foundation, offers a replicable framework for other Islamic institutions

seeking to bridge the religious-scientific dichotomy. By prioritizing interdisciplinary synergy, this approach can be adapted by other universities to enhance curriculum relevance (Holley, 2009), fostering graduates capable of addressing contemporary societal challenges with a balanced perspective (AlQhtani, 2025; Flori et al., 2025). The model's emphasis on measurable credit distribution and integrative courses provides a scalable blueprint for Islamic higher education institutions globally.

While the curriculum structure at UIN K.H. Abdurrahman Wahid Pekalongan effectively implements scientific harmonization with a balanced 44%:36% ratio of general to religious sciences and 17% integrative courses, the minimal inclusion of technology-related courses (only 3%) represents a significant limitation in addressing the demands of the Industry. This shortfall may hinder graduates' ability to engage with emerging technological advancements, potentially reducing their competitiveness in fields requiring digital literacy and innovation (Nasrullah et al., 2024; Rikala et al., 2024; Singun, 2025; Thomais Gkrimpizi et al., 2023). To address this weakness, it is recommended that the university incorporate additional technology-focused courses, such as data analytics or Islamic perspectives on artificial intelligence, to enhance the curriculum's relevance (Djazilan et al., 2024; Elmahjub, 2023; Guan et al., 2020). A critical synthesis of these findings suggests that while the harmonization model fosters interdisciplinary competence, its limited technological integration underscores the need for strategic curriculum enhancements to better prepare students for contemporary global challenges.

Concept of Scientific Harmonization at UIN K.H. Abdurrahman Wahid Pekalongan from the Perspective of Ontology, Epistemology and Axiology

Islamic teachings position monotheism as a scientific ontology which is the starting point or upstream and downstream of all knowledge on earth. Faith as faith in Allah and his books and messengers has become the main key to the birth of science which is also the source of all knowledge (Al-Qur'an Hadith). Tauhid is the foundation for the birth of various sciences. Harmonization of science is actually the reality that the essence of science is not separate (dichotomous) and not divided (fragmentary).

UIN academic draft K.H. Abdurrahman Wahid Pekalongan explains that the term harmony is defined as a pattern, namely an attempt to reconcile various contradictions and claims about the existence of each science. Harmony is the most important factor in the pluralistic scientific dialectic amidst the endless dynamics of science and technology. Alignment of roles between sciences will be able to create harmonious scientific dynamics. The term harmonious is an adjective which has the meaning of being related to (concerning) harmony; agree. Harmony means that everything should always be in harmony, harmony, balance ("KBBi Online" n.d.).

To synergize various sciences that have different paradigms and scopes, a systematic science harmonization process is needed to realize harmony, compatibility, suitability and balance between the various factors that differentiate each science's characteristics so that these factors produce unity or form one whole. the noble as part of the system. Elements that can be drawn on in the harmonization process include: a). minimize things that cause excessive differences and tension, b). aligning the functions and roles of each science to form a system that complements and perfects each other, c). differences in scientific identity are sought to find points of contact in order to realize harmony, suitability, suitability and balance, and d). synergistic cooperation between the similar roles of each science to produce synergy, dialectics and harmonization which leads to prosperity and peace in society.

Etymologically, the term harmonization refers to a process that begins with an effort to achieve or realize a harmonious system to bring it into a harmonious atmosphere.

Harmonization necessitates a process or effort to harmonize, harmonize or adjust something that is considered unsuitable or inappropriate, inadequate or incompatible, so as to produce something good or harmonious in various ways.

The character of science and the values of science will become the color of thinking, learning, research and service at UIN K.H. Abdurrahman Wahid Pekalongan to the people. The academic community and alumni have signs in every scientific and non-scientific activity. So whoever and wherever they are, their knowledge and values will always be the spirit in all their actions. This is the civilization of knowledge values developed by the campus in preparing the millennial generation to have excellence in assembling Islamic civilization in the future.

Scientific axiology focuses on aspects of the values and goals of science. This scientific harmonization has the character of *Tawassuth* (middle) (Tri Wulandari, 2023), *Tawazun*, *I'tidal* and *Tasamuh* (Tolerance) (Helmawati et al., 2024) which are specifically intended for humans as a bridge in maintaining religion (*hifd ad-din*), maintaining the soul (*hifdz an-nafs*), maintaining the mind (*hifdz al-aql*), maintaining wealth (*hifdz al-mal*) and maintaining offspring (*hidfzal Nasl*) (Supena, 2022). UIN K.H. Abdurrahman Wahid Pekalongan will be a place to meet and dialogue various kinds of knowledge which will then form harmonization to solve life's problems. Harmonization of science at UIN K.H. Abdurrahman Wahid Pekalongan will always be Rahmatalil Alamin for anyone who wants to use it. The definition of harmonization, as an effort and as a process, namely as an effort or process that wants to overcome the boundaries of differences, contradictions and irregularities.

Classification of science or fields of science has been carried out by previous scholars to make it easier to focus on ontology, epistemology and axiology because objects vary even from the same subject source. Likewise with variations in the way of concocting (methods) from these different objects. UIN K.H. Abdurrahman Wahid Pekalongan mapped in table 1 the field of science into five scientific family disciplines including.

Table 1. Table of Scientific Discipline Groups

Family of Scientific Disciplines				
Revelation-based sciences	Natural Science	Social Science	Humanities	Tool Science
Al-Qur'an	Physics	Sociology	History	Logic
Al-Hadits	Chemistry	Anthropology	Literature	Matematics
Sufism	Biology	Psychology	Politic	Language
Morals	Botany	Education	Philosophy	Statistics
Kalam	Zoology	Geography	Law	Rhetoric
Fikih	Geology	Communication	Arkeology	Technique
Sirah	Medical	Management	and others	and others
and others that are allied	Astronomy and others that are allied	and others that are allied	that are allied	that are allied

The scientific philosophy adopted by UIN K.H. Abdurrahman Wahid Pekalongan is grounded in the ontological, epistemological, and axiological foundations of knowledge, which give rise to the sciences of revelation, natural sciences, social sciences, humanities, and tool sciences. The development of these disciplines emphasizes the values of *tawassuth* (moderation), *tawazun* (balance), *i'tidal* (justice), and *tasamuh* (tolerance) as

guiding principles (Haris et al., 2024). This framework is directed toward achieving five noble objectives (*maqasid al-shariah*): *hifdz ad-din* (protection of religion), *hifdz an-nafs* (protection of life), *hifdz al-'aql* (protection of intellect), *hifdz al-mal* (protection of wealth), and *hifdz al-nasl* (protection of lineage) (Suprpto, 2020). These goals are operationalized across study programs, faculties, and postgraduate levels through strategies of individual development, community empowerment, national policy contributions, and institutional advancement. Accordingly, UIN K.H. Abdurrahman Wahid Pekalongan aspires to produce graduates who embody noble character, entrepreneurial independence, professional competence, competitiveness in real-world contexts, and both national and global perspectives (Sulton, 2024; Syaifuddin et al., 2025).

Beyond its normative dimension, the philosophy of scientific harmonization also has practical significance, particularly in reinforcing the principle of moderation in the contemporary relationship between religion and science. This relevance is evident in three key aspects of technological development: human-centered, technology-based, and artificial intelligence (Ma'arif, 2022). In the human-centered domain, the institution integrates divine values into human resource management, ensuring that academic disciplines are consistently connected to revelatory (*naqli*) and empirical (*waq'i'i*) foundations. In the technology-based domain, the paradigm of *sharia*-oriented thinking enables the academic community to harness technology as a corrective tool against biased or extremist interpretations, thereby supporting religious moderation. Finally, in relation to artificial intelligence, UIN K.H. Abdurrahman Wahid Pekalongan promotes a positive integration of AI into the academic environment. By grounding AI applications in human values and ethical considerations, the academic community fosters critical thinking, supports economic innovation, addresses social issues, and strengthens religious moderation.

Conclusion

Based on the results of this study, several conclusions can be drawn. First, UIN K.H. Abdurrahman Wahid Pekalongan adopted the philosophy of scientific harmonization to overcome the long-standing dichotomy between religious and general sciences, which has historically weakened Islamic intellectualism. Rooted in the broader concept of moderation, this philosophy rejects extremes, avoiding both purely theocentric and purely anthropocentric orientations. Instead, it cultivates a balanced integration of knowledge that fosters synergy across disciplines. The idea of harmonization is envisioned as an "Arc of Scientific Harmonization," symbolized by a "Scientific Orchestra," where *tauhid* (monotheism) serves as the ontological foundation. This framework positions knowledge as both the origin and endpoint of inquiry, axiologically directed toward human welfare and the sustainability of civilization.

Second, the curriculum structure at UIN K.H. Abdurrahman Wahid Pekalongan has operationalized this philosophy by offering courses with a balanced distribution of credits: 44% allocated to general sciences, 36% to religious sciences, and 17% to integrative courses that combine both domains. This balance reflects an intentional effort to implement scientific harmonization in practice. However, the study also identified a significant limitation: technology-related courses account for only 3% of the curriculum, a proportion that is insufficient given the demands of the Industrial Revolution 4.0 and the growing importance of digital literacy, artificial intelligence, and data-driven skills.

To strengthen the model, the university is encouraged to expand the proportion of technology-focused courses and enhance interdisciplinary modules that merge Islamic ethics with contemporary scientific methodologies. For other Islamic higher education institutions, the adoption of a similar harmonization framework, anchored in balanced

credit distribution and integrative learning, could help cultivate graduates with holistic competencies that combine spiritual integrity with professional expertise.

Finally, this study provides broader implications for educational policy and curriculum design. The harmonization model developed at UIN K.H. Abdurrahman Wahid Pekalongan offers a replicable framework for other Islamic universities across Indonesia. Its balanced credit ratio and integrative course model can inform national higher education policies that aim to bridge the religious–scientific divide, while also mandating greater inclusion of technology-based courses. By embracing this model, Islamic higher education institutions can align more closely with global academic trends, ensuring that graduates contribute meaningfully to societal progress through a synthesis of moderation, innovation, and interdisciplinary problem-solving.

References

- Adinugraha, H. H., Hidayanti, E., & Riyadi, A. (2018). Fenomena Integrasi Ilmu di Perguruan Tinggi Keagamaan Islam Negeri: Analisis Terhadap Konsep Unity of Sciences di UIN Walisongo Semarang. *Hikmatuna: Journal for Integrative Islamic Studies*, 4(1), 1–24. <https://doi.org/10.28918/HIKMATUNA.V4I1.1267>
- Adiyono, A., Fitri, A. Z., & Al Matari, A. S. (2024). Uniting Science and Faith: A Re-STEAM Interdisciplinary Approach in Islamic Education Learning. *International Journal of Social Learning (IJSLS)*, 4(3), 332–355. <https://doi.org/10.47134/ijsl.v4i3.281>
- Albi Anggito, J. S. (2018). Metodologi Penelitian Kualitatif. In E. D. Lestari (Ed.), *CV Jejak*. CV Jejak.
- AlQhtani, F. M. (2025). Knowledge Management for Research Innovation in Universities for Sustainable Development: A Qualitative Approach. *Sustainability (Switzerland)*, 17(6). <https://doi.org/10.3390/su17062481>
- Djazilan, M. S., Rulyansah, A., & Rihlah, J. (2024). Why AI is Essential for the Future of Islamic Education: A Call for Ethical and Effective Implementation. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, 5(2), 201–216. <https://doi.org/10.62775/edukasia.v5i2.1373>
- Elmahjub, E. (2023). Artificial Intelligence (AI) in Islamic Ethics: Towards Pluralist Ethical Benchmarking for AI. *Philosophy and Technology*, 36(4), 1–24. <https://doi.org/10.1007/s13347-023-00668-x>
- Endang, W. W. (2018). Teori Dan Praktik Penelitian Kuantitatif Kualitatif Penelitian Tindakan Kelas (PTK) Research and Development (R&D). In *Bumi Aksara*. Bumi Aksara.
- Flori, M., Raulea, E. C., & Raulea, C. (2025). Innovative leadership and sustainability in higher education management. *Computers and Education Open*, 9(August 2024), 100272. <https://doi.org/10.1016/j.caeo.2025.100272>
- Guan, C., Mou, J., & Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. *International Journal of Innovation Studies*, 4(4), 134–147. <https://doi.org/10.1016/j.ijis.2020.09.001>
- Hadi, A., Anim, S., & Yasin, H. (2024). Integration of Islamic Principles and Modern Educational Theories in Islamic Education. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama*, 16(2), 1385–1398. <https://doi.org/10.37680/qalamuna.v16i2.6105>
- Hanif, A., Syarifudin, E., & Muhtarom, A. (2025). Integration of Religious Moderation in Islamic Education: Challenges and Opportunities in the Digital Era. *Edukasi Islami: Jurnal Pendidikan Islam*, 14(01), 49–66. <https://doi.org/10.30868/ei.v14i01.7767>
- Haris, A., Mardani, D. A., Kusnandar, E., & Mas'ad, M. A. (2024). Strengthening Religious Moderation through the Merdeka Curriculum: The Role of Islamic Religious Education Teachers at Public Senior High School. *EDUKASI: Jurnal Penelitian Pendidikan Agama Dan Keagamaan*, 22(3), 423–438.

- <https://doi.org/10.32729/EDUKASI.V22I3.1958>
- Helmawati, H., Marzuki, M., Hartati, R. S., & Huda, M. (2024). Islamic Religious Education and Religious Moderation at University. *EDUKASI: Jurnal Penelitian Pendidikan Agama Dan Keagamaan*, 22(1), 111–124. <https://doi.org/10.32729/EDUKASI.V22I1.1689>
- Hermawan, I. (2019). Metodologi Penelitian Pendidikan Kualitatif, Kuantitatif dan Mixed Method. In *Hidayatul Quran*. Hidayatul Quran.
- Holley, K. A. (2009). Interdisciplinary Strategies as Transformative Change in Higher Education. *Innov High Educ*, 34, 331–344. <https://doi.org/https://doi.org/10.1007/s10755-009-9121-4>
- Ijatuyi, E. J., Lamm, A., Yessoufou, K., Suinyuy, T., & Patrick, H. O. (2025). Integration of indigenous knowledge with scientific knowledge: A systematic review. *Environmental Science and Policy*, 170(October 2024), 104119. <https://doi.org/10.1016/j.envsci.2025.104119>
- Jendri. (2019). Hubungan Sains dengan Agama Perspektif Pemikiran Ian G Barbour. *Tajdid: Jurnal Ilmu Ushuluddin*, 18(1), 57–78.
- John M. Echlos, H. S. (2003). *Kamus Inggris Indonesia*. Gramedia Pustaka Utama.
- Lim, W. M. (2025). What Is Qualitative Research? An Overview and Guidelines. *Australasian Marketing Journal*, 33(2), 199–229. <https://doi.org/10.1177/14413582241264619>
- Ma'arif, A. A. (2022). Membangun Komunikasi antara Agama dan Pembangunan. *JIS: Jurnal Iman Dan Spiritual*, 2(1). <https://doi.org/https://doi.org/10.15575/jis.v2i1.16877>
- Manshuruddin, M., Mardianto, M., & Halimah, S. (2025). Design and Implementation of the Mu'adalah Curriculum at Musthafawiyah Islamic Boarding School: Balancing Tradition and Innovation. *AL-ISHLAH: Jurnal Pendidikan*, 17(2), 2590–2602. <https://doi.org/10.35445/alishlah.v17i2.6732>
- Mariyono, D. (2024). Multicultural values: meeting point of two forces in developing Islamic education. *Quality Education for All*, 1(1), 46–69. <https://doi.org/10.1108/QEA-02-2024-0018>
- Mlotshwa, N., & Tsakeni, M. (2024). Challenges Experienced by Teachers when Integrating Indigenous Knowledge Systems in Natural Sciences Practical Work. *African Journal of Research in Mathematics, Science and Technology Education*, 28(2), 300–313. <https://doi.org/10.1080/18117295.2024.2414160>
- Mohammad Syaifuddin, Siti Sa'adah, Reza Hidayat, S. (2024). Strategi Internalisasi Karakter Moderat di Pondok Pesantren Al-Utsmani Kabupaten Pekalongan. *El-Fakhr*, 4(1), 28–44. <https://doi.org/10.46870/ELFAKHURU.V4I1.1185>
- Muhlisin, M. S. (2020). The Implementation of Integrated Islamic Education Model at MAN Insan Cendekia Pekalongan. *Edukasia Islamika*, 5(1), 68–87. <https://doi.org/10.28918/JEI.V5I1.2559>
- Mukhibat, M., Effendi, M., Setyawan, W. H., & Sutoyo, M. (2024). Development and evaluation of religious moderation education curriculum at higher education in Indonesia. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186X.2024.2302308>
- Muzhiat, A., & Kartanegara, M. (2020). Integrasi Ilmu dan Agama; Studi atas Paradigma Integrasi, Komparasi, Difusi Menuju Perguruan Tinggi Keagamaan Islam (PTKIN) yang Unggul. *Al Qalam*, 37(1), 69–88. <https://doi.org/10.32678/ALQALAM.V37I1.3648>
- Nasrullah, R., Laksono, K., Prayogi, A., Parmin, P., & Inayatillah, F. (2024). Establishing Literacy Foundations : Policies and Interventions for Indonesia's Future Excellence. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang*

- Pendidikan, Pengajaran Dan Pembelajaran*, 10(3), 1219–1230. <https://doi.org/10.33394/jk.v10i3.11011>
- Nawas, A., Darmawan, I. G. N., & Maadad, N. (2025). Certified to succeed? Multilevel analysis of the effects of teacher certification on educator well-being and student outcomes in Indonesia. *Teaching and Teacher Education*, 162(May). <https://doi.org/10.1016/j.tate.2025.105069>
- RI, J. B. (2022). *PERPRES No. 86 Tahun 2022 tentang Universitas Islam Negeri K.H. Abdurrahman Wahid Pekalongan*.
- Rifai, N., Fauzan, F., & Bahrissalim, B. (2014). Integrasi Keilmuan dalam Pengembangan Kurikulum di UIN se-Indonesia: Evaluasi Penerapan Integrasi Keilmuan UIN dalam Kurikulum dan Proses Pembelajaran. *TARBIYA: Journal of Education in Muslim Society*, 1(1), 13–34. <https://doi.org/10.15408/TJEMS.V1I1.1108>
- Rikala, P., Braun, G., Järvinen, M., Stahre, J., & Hämäläinen, R. (2024). Understanding and measuring skill gaps in Industry 4.0 — A review. *Technological Forecasting and Social Change*, 201(November 2023). <https://doi.org/10.1016/j.techfore.2024.123206>
- Riwanda, A., Huda, H., Nadlir, N., & Yani, A. (2024). Integrating Science and Religion through Academic Writing: A Case Study at MAN Insan Cendekia. *EDUKASI: Jurnal Penelitian Pendidikan Agama Dan Keagamaan*, 22(2), 167–183. <https://doi.org/10.32729/edukasi.v22i2.1869>
- Rosyada, D. (2020). *Penelitian Kualitatif Untuk Ilmu Pendidikan* -. Kencana.
- Rumuskan Visi keilmuan UIN, IAIN Pekalongan Gelar FGD*. (n.d.).
- Sejarah*. (n.d.).
- Singun, A. J. (2025). Unveiling the barriers to digital transformation in higher education institutions: a systematic literature review. In *Discover Education* (Vol. 4, Issue 1). Springer International Publishing. <https://doi.org/10.1007/s44217-025-00430-9>
- Sudaryono. (2016). *Metode Penelitian Pendidikan*. Kencana.
- Sugiono. (2005). *Memahami Penelitian Kualitatif*. Alfabeta.
- Sulton, A. (2024). Strategies for Responding to Academic and Workplace Challenges in Islamic Higher Education. *Edukasia Islamika*, 9(1), 61–78. <https://doi.org/10.28918/jei.v9i1.6887>
- Suneki, S., Yunus, M., & Haryono. (2023). Maintaining Harmonization In Preventing Potential Social- Religious Conflicts In The City of Semarang Through Community Pluralism Education. *Edukasi Islami: Jurnal Pendidikan Islam*, 12(01), 1079–1090.
- Supena, I. (2022). The Integration of Islamic Sciences and Secular Sciences Through Spiritualization and Humanization Approaches. *Hikmatuna: Journal for Integrative Islamic Studies*, 8(1), 1–15. <https://doi.org/10.28918/HIKMATUNA.V8I1.4657>
- Suprpto. (2020). Integrasi Moderasi Beragama dalam Pengembangan Kurikulum Pendidikan Agama Islam. *EDUKASI: Jurnal Penelitian Pendidikan Agama Dan Keagamaan*, 18(3), 355–368. <https://doi.org/10.32729/EDUKASI.V18I3.750>
- Suwendra, I. W. (2018). *Metodologi Penelitian Kualitatif dalam Ilmu Sosial, Pendidikan, Kebudayaan dan Keagamaan* (Pertama, Issue 1). Nilacakra.
- Syaifuddin, M. (2021). Strategi Manajemen Struktur Kurikulum Integratif di MAN Insan Cendekia Pekalongan. *Tawshiyah: Jurnal Sosial Keagamaan Dan Pendidikan Islam*, 16(1), 24–36. <https://doi.org/10.32923/taw.v16i1.1617>
- Syaifuddin, M. (2022). Harmonizing Religious Science and Technology Through Boarding School System: A Case at a State Islamic Senior High School. *Tadibia Islamika*, 2(1), 23–33. <https://doi.org/10.28918/tadibia.v2i1.5604>
- Syaifuddin, M., Sopiha, Annur, A. F., Prayogi, A., & Alias, N. (2025). Improving Academic Culture Through MBKM-Based Curriculum Construction at Islamic Higher Education Institution. *Edukasia: Jurnal Penelitian Pendidikan Islam*, 20(1), 49–70. <https://doi.org/http://dx.doi.org/10.21043/edukasia.v20i1.31427>

- Syaifuddin, M., & Taufiq, A. (2023). Study of Moderation Verses in the Perspective of Nusantara Tafsir. *Aqwal: Journal of Qur'an and Hadis Studies*, 4(2), 138–156. <https://doi.org/10.28918/AQWAL.V4I2.1711>
- Thomais Gkrimpizi, Peristeras, V., & Magnisalis, I. (2023). Classification of Barriers to Digital Transformation in Higher Education Institutions: Systematic Literature Review. *Education Sciences*, 13(746), 1–24. <https://doi.org/10.3390/educsci13070746>
- Tri Wulandari, B. Z. (2023). Pembinaan Sikap Disiplin dan Tawassuth Pada Santri Pondok Pesantren Salafiyah Darussalam Boyolali. *Jurnal Penelitian*, 16(2), 345–370. <https://doi.org/10.21043/JP.V16I2.16977>
- Triyono, I. N. A. Z. R. (2021). Integration of Islam and Science in Islamic Education. *Hikmatuna: Journal for Integrative Islamic Studies*, 7(1), 69–78. <https://doi.org/10.28918/HIKMATUNA.V7I1.3648>
- Viera Trevisan, L., Leal Filho, W., & Ávila Pedrozo, E. (2024). Transformative organisational learning for sustainability in higher education: A literature review and an international multi-case study. *Journal of Cleaner Production*, 447(January). <https://doi.org/10.1016/j.jclepro.2024.141634>
- Zuo, H., Zhang, M., & Huang, W. (2025). Lifelong learning in vocational education: A game-theoretical exploration of innovation, entrepreneurial spirit, and strategic challenges. *Journal of Innovation and Knowledge*, 10(3), 100694. <https://doi.org/10.1016/j.jik.2025.100694>