



## Integration of AI and PBL to improve the quality of Islamic religious education: Bibliometric analysis

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### ABSTRACT

The development of digital technology has driven a significant transformation on the world of education, including in Islamic Religious Education (PAI) learning. This study aims to analyze the integration of artificial intelligence (AI) and the Problem-Based Learning (PBL) model to improve the quality of Islamic Education learning in the digital era. The research method used is a bibliometric study of various national and international scientific publications published in the range of 2020-2025. The results of the analysis show that the application of AI and PBL will be increasingly researched and implemented in 2024, especially related to the innovation of learning methods, the effectiveness of the learning process, and the improvement of digital-based religious literacy. The integration of AI with PBL is considered capable of strengthening students' collaboration, creativity, and problem-solving skills in the context of Islamic learning. The results of systematic analysis also identified several effective implementation models, such as AI-PBL-based hybrid classrooms and the use of chatbots or digital tutor applications in supporting collaborative learning. This research has comprehensively analyzed the integration of AI and PBL learning models in an effort to improve the quality of Islamic education in the digital era.

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### ABSTRAK

Perkembangan teknologi digital telah mendorong transformasi besar dalam dunia pendidikan, termasuk dalam pembelajaran Pendidikan Agama Islam (PAI). Penelitian ini bertujuan untuk menganalisis integrasi kecerdasan buatan (AI) dan model Problem Based Learning (PBL) dalam upaya meningkatkan mutu pembelajaran PAI di era digital. Metode penelitian yang digunakan adalah kajian bibliometrik terhadap berbagai publikasi ilmiah nasional dan internasional yang terbit pada rentang tahun 2020-2025. Hasil analisis menunjukkan bahwa penerapan AI dan PBL semakin banyak diteliti dan diimplementasikan pada tahun 2024, terutama terkait inovasi metode pembelajaran, efektivitas proses belajar, dan peningkatan literasi keagamaan berbasis digital. Integrasi AI dengan PBL dinilai mampu memperkuat kolaborasi, kreativitas, serta kemampuan pemecahan masalah peserta didik dalam konteks pembelajaran agama Islam. Hasil analisis sistematis pun mengidentifikasi beberapa model implementasi yang efektif, seperti hybrid classroom berbasis AI-PBL dan pemanfaatan chatbot atau aplikasi tutor digital dalam mendukung pembelajaran kolaboratif. Penelitian ini secara komprehensif telah menganalisis integrasi AI dan model pembelajaran PBL dalam upaya meningkatkan kualitas PAI di era digital.

**Kata Kunci:** bibliometrik; kecerdasan buatan; pembelajaran berbasis masalah; pendidikan agama Islam

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## INTRODUCTION

The development of digital technology has brought fundamental changes across various aspects of life, including education. In the era of the 4.0 industrial revolution and society 5.0, the challenges in education are not only in delivering the Material but also in preparing students to navigate global dynamics, think critically, collaborate, and adapt to technological advancements. Islamic Religious Education (PAI), as one of the pillars of the nation's character and spiritual formation, is no exception to the demand for technology-based innovation to improve the quality of learning and the relevance of the Material to the needs of the era (Jannah *et al.*, 2025). The implementation of artificial intelligence (AI) in education is beginning to have a significant impact, particularly in the presentation of Material, assessment, and the personalization of the learning process. AI can provide adaptive, responsive learning experiences, enabling the potential and learning needs of students to be optimally accommodated. On the other hand, Problem-Based Learning (PBL), a learning model that emphasizes solving real-world problems, collaboration, and the development of critical thinking, has been shown to promote active student engagement and improve learning outcomes, including in Islamic education (Salsabila *et al.*, 2022).

In recent years, various studies have shown that technology-based innovation has become a key driver of improved learning effectiveness across educational levels, including Islamic Religious Education (PAI). The implementation of AI in the educational environment has proven capable of creating a more personalized, interactive, and adaptive learning experience tailored to each student's needs. Research indicates that using AI in PAI learning can increase students' motivation and participation by aligning the Material more closely with individual characteristics (Inayati, 2022). The use of AI in learning systems can provide real-time feedback and adjust the Material's difficulty level to learners' abilities. In addition, the application of PBL is expanding due to its effectiveness in enhancing learners' critical thinking, collaboration, creativity, and problem-solving abilities. PBL places learners at the center of the learning process by presenting real-world challenges to be solved collaboratively, thereby encouraging active learner engagement (Dewi *et al.*, 2024). Various studies confirm that implementing PBL in Islamic religious education not only improves students' learning outcomes and motivation but also helps develop spiritual, intellectual, and social competencies.

Research indicates that integrating PBL into Islamic Education can significantly enhance students' ability to analyze and reflect on Islamic values (Budiyanto, 2023). Although various studies have examined the use of technology and innovative learning models in Islamic Education (PAI), the optimal integration of AI and PBL remains underexplored, particularly from a bibliometric and systematic perspective. Amid the rapid pace of digitalization, it is important to examine how Research trends, practical implementation, and the challenges and opportunities of integrating AI and PBL in PAI have evolved over the past decade. By reviewing both global and national literature and trends, it is expected that patterns of innovation and appropriate strategies can be identified to strengthen the quality of PAI while also addressing the needs of a modern, digitally driven society (Tanjung & Suteki, 2024). Therefore, Research on the integration of AI and PBL-based learning innovations in Islamic religious education is highly relevant and warrants an in-depth, systematic study as a foundation for developing a more adaptive, inclusive, and competitive religious education in the digital era.

Nonetheless, Research on integrating AI and PBL in Islamic religious education remains very limited. Most existing studies position AI merely as an administrative tool, for assessment, or as a support for learning media, while PBL applications are still often carried out conventionally without advanced technological support. Studies specifically examining how AI can enhance the effectiveness of PBL in Islamic education settings remain scarce. The results highlight the need for a more in-depth analysis of integrating these two

approaches to create learning that is more innovative, effective, and relevant to learners' needs in the digital era (Rahman *et al.*, 2021). Therefore, this study is designed to address these gaps using bibliometric approaches and systematic reviews. By mapping and analyzing prior studies, this study aims to identify the main trends, the most effective implementation models, and the opportunities and challenges of integrating AI and PBL to improve the quality of PAI learning. This article offers a novel contribution in the form of a comprehensive integrative analysis, expected to serve as a strategic reference for the development of technology-based Islamic religious education theory and practice in the era of digital transformation.

This study aims to comprehensively analyze the integration of AI into PBL to enhance Islamic Religious Education (PAI). Specifically, this study is designed to identify the latest Research trends regarding the implementation of AI and PBL in the context of religious education, conduct a systematic analysis of the effectiveness of integrating these two approaches in strengthening students' religious and academic competencies, and formulate optimal strategies or implementation models for AI-PBL integration in PAI learning practices across various educational levels. This Research is practically beneficial as a reference for developing an innovative and adaptive AI- and PBL-based Islamic Education learning model, and academically enriches the study of the integration of digital technology in Islamic education through bibliometric and systematic studies. In general, this Research aims to support the realization of adaptive, relevant, and sustainable Islamic education amid global digital development, and to help create a generation of Muslims who are spiritually and intellectually prepared to face future challenges.

## LITERATURE REVIEW

### **Problem-Based Learning (PBL)**

Problem-Based Learning (PBL) is a learning model that focuses on solving real-world problems and places students at the center of the learning process. This model was first developed by Howard S. Barrows and Robyn M. Tamblyn in the late 1960s at the Faculty of Medicine, McMaster University, in Canada, in response to the need for education that is more applicable to the real world. PBL is grounded in a constructivist perspective, in which learning is understood as an active process of constructing knowledge and understanding through experience and interaction with the environment (Purnomo *et al.*, 2019). The essence of the PBL approach is the provision of contextual scenarios or problems that prompt students to work collaboratively to analyze, discuss, and develop solutions.

In PBL, the teacher's role is more that of a facilitator than a main source of knowledge. Students are encouraged to be independent in seeking information and in developing critical thinking, communication, and collaboration skills (Budiyanto, 2023; Handoyo *et al.*, 2024). In its implementation in Islamic Religious Education (PAI), PBL is seen as capable of fostering the analytical, reflective, and contextual application of Islamic values. Through problem-solving related to socio-religious issues, students are invited to integrate religious knowledge with real-life experiences, making learning more meaningful and relevant. This PBL model is also effective in enhancing students' learning motivation, collaboration skills, and the development of their spiritual and social character (Inayati, 2022).

### **Artificial Intelligence in Education**

Artificial Intelligence (AI) is a branch of computer science that focuses on developing systems capable of performing tasks that typically require human intelligence, such as understanding language, recognizing patterns, making decisions, and learning from experience. In education, the application of AI has advanced rapidly, alongside the growing need for more personalized, adaptive, and efficient learning. One important

theory of AI in education, developed by Luckin, highlights AI as a partner in creating a learning ecosystem that is more responsive and relevant to individual learners' needs (Adib, 2022). AI can support personalized learning by presenting Material that matches the learner's ability level and learning style, and by providing automatic, real-time feedback (Zakariyah *et al.*, 2022).

AI-based adaptive learning systems can identify students' strengths and weaknesses and automatically adjust learning content and activities to improve learning effectiveness. In addition, AI is used to develop virtual tutors, educational chatbots, and automated assessment systems that help teachers monitor students' progress more accurately and efficiently. In Islamic religious education, AI is beginning to be developed to support the learning process, such as through digital applications for understanding religious materials, AI-based virtual discussion boards, and learning analytics-based assessments. The presence of AI in this context not only enhances the effectiveness of learning but also creates opportunities to integrate religious education in a more interactive manner that aligns with contemporary contexts (Jannah & Puspita, 2023).

### **The Concept of Digital Literacy in Religious Education**

Digital literacy is one of the key competencies needed to face the rapid development of information and communication technology. Gilster first introduced the concept of digital literacy as the ability to understand and use information in various formats obtained through computers and the internet. Digital literacy encompasses not only technical skills in using digital devices but also critical thinking, information evaluation, and the ethical and responsible use of technology (Rahmawati, 2022). Along with the development of the digital era, the theory of digital literacy continues to expand. Digital literacy comprises various elements, including technological expertise, sociocultural understanding, and cybersecurity awareness (Fauziyah *et al.*, 2023).

In education, digital literacy has become an important part of curriculum development because it prepares students to access, evaluate, and use information effectively in both learning and everyday life. In the context of Islamic Religious Education (PAI), digital literacy is becoming increasingly relevant as technology-based learning continues to evolve. Students are required not only to understand religious values but also to use digital technology to access Islamic resources, engage in online discussions, and broaden their religious insight more extensively and openly. Digital literacy in PAI is also related to students' ability to distinguish valid information from religious hoaxes and to develop a critical and wise attitude toward using digital media (Rafliyanto & Mukhlis, 2023).

### **Educational Innovation and Technology Integration**

Educational innovation is the process of developing and applying new ideas, methods, or technologies to improve the quality of learning and the relevance of education to contemporary needs. One of the widely influential theories of innovation in education is the Diffusion of Innovations developed by Everett M. Rogers. The adoption of innovations in educational settings is influenced by five main factors: relative advantage, compatibility, complexity, trialability, and observability. This theory emphasizes the importance of individual and institutional readiness in accepting and implementing changes, including technology-based innovations. In addition to Rogers' theory, Research highlights the importance of change leadership and a collaborative culture in the success of educational innovation (Umam *et al.*, 2023).

Innovation in education is not only about using new tools or methods, but also about shifting the paradigms of learning, communication, and assessment. This paradigm shift is highly relevant in the context of digital

technology integration, where teachers, students, and the school environment must adopt an open, adaptive approach to a continuously evolving technology landscape. The integration of technology into learning is further supported by frameworks such as TPACK (Technological Pedagogical Content Knowledge), which emphasizes the need to balance content mastery, pedagogical understanding, and technological skills to make learning effective and meaningful (Mishra & Koehler, 2006). The application of TPACK is particularly crucial when teachers integrate AI technology or PBL methods into instruction.

## METHODS

This study uses a bibliometric approach combined with a systematic review to analyze trends and developments in Research related to the integration of artificial intelligence (AI) and Problem-Based Learning (PBL) in Islamic Religious Education (PAI). All data were obtained from the Scopus database for the period 2020 to 2025. The process of identifying and selecting articles was carried out systematically using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow, which consists of several stages as follows:

1. In the identification stage, the literature search was conducted in the Scopus database using Boolean Logic with the keywords “artificial intelligence AND problem-based learning AND Islamic education” and a publication year filter of 2020-2025, resulting in 124 articles.
2. Screening, in this process, the articles found were selected based on their titles and abstracts to ensure relevance to the Research topic and to remove duplicates, leaving 89 relevant articles.
3. Eligibility: articles that passed the screening stage were then analyzed in full text, leaving 56 articles deemed eligible.
4. In this final stage, 37 articles met all the criteria, namely, discussing the integration of AI and/or PBL in Islamic Education and published in Scopus-indexed journals. Subsequently, this data was analyzed bibliometrically and systematically in this study.

Bibliometric analysis using VOSviewer software produces a visual map that shows publication trends, author collaboration networks, frequently occurring keywords, and relationships between Research institutions. The findings from this analysis are then interpreted descriptively to identify patterns, tendencies, and major developments in Research on AI integration and PBL in Islamic education learning over the past decade.

## RESULTS AND DISCUSSION

### Bibliometric Findings (Trend Statistics)

A bibliometric analysis of scientific publications on the integration of artificial intelligence (AI) and Problem-Based Learning (PBL) in Islamic Religious Education (PAI) shows a significant increase in the number of studies over the past decade, particularly during the period 2020-2025. **Table 1** illustrates the number of scientific publications on the integration of AI and PBL in PAI from 2020 to 2025.

**Table 1.** Number of Scientific Publications on the Integration of AI and PBL in PAI from 2020 to 2025

Year	Number of Publications	Data Source	Notes/Dominant Theme
2020	4	Scopus	The beginning of digitalization Research in PAI, AI for assessment
2021	6	Scopus	Surge during the pandemic, online learning, AI-PBL

Year	Number of Publications	Data Source	Notes/Dominant Theme
2022	7	Scopus	Indonesia-Malaysia collaboration, AI for personalization
2023	8	Scopus	Interactive digital media, PAI chatbots
2024	9	Scopus	Hybrid AI-PBL models, enhancing digital competence
2025	3	Scopus	Digital assessment innovations, digital literacy of teachers and students
<b>Total</b>	<b>37</b>		

Source: 2025 Research

Based on an investigation of the Scopus database (see **Table 1**), 37 publications discuss the implementation of AI, learning model innovations, and PBL in the context of religious education at the elementary, secondary, and higher education levels (Mutiara, 2023). Statistically, the number of publications related to AI and PBL in Islamic Education has rapidly increased since the COVID-19 pandemic, alongside the acceleration of digital transformation in the education sector. The year 2024 marks a surge in publications, with a total of 9 articles. This trend reflects an urgent need for technology-based learning innovations to address challenges of distance learning and adaptation in the digital era (Purnomo *et al.*, 2022).

**Table 2.** Distribution of AI and PBL Publications in Islamic Education (PAI) in Several Countries (Scopus Data 2020-2025)

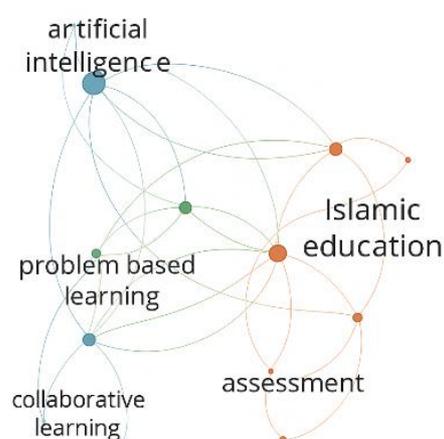
Country	Number of Publications	Percentage (%)	Dominant Theme
Indonesia	17	45,9%	Digitalization of PAI, Hybrid Learning, AI for assessment
Malaysia	8	21,6%	Digital content, AI for madrasahs, blended PBL
Middle East	5	13,5%	AI, Qur'an, digital literacy, religious assessment
Europe	4	10,8%	International collaboration, hybrid curriculum
Others	3	8,1%	Comparative studies, innovation development
<b>Total</b>	<b>37</b>	<b>100%</b>	

Source: 2025 Research

Based on the Scopus database search results (see **Table 2**) for the 2020-2025 period, there is a trend of increasing scientific publications on the integration of AI and PBL in Islamic Religious Education (PAI) across various countries. Of the 37 articles that met the inclusion criteria for this study, Indonesia is the country with the highest number of articles, 17 (45.9%), discussing the digitalization of PAI, hybrid learning models, and the use of AI for assessment. Malaysia ranks second with 8 articles (21.6%) focusing on the development of digital content, AI implementation in madrasahs, and the application of blended PBL. The Middle Eastern region (such as Egypt and Saudi Arabia) contributed 5 articles (13.5%) with the main themes being the application of AI in Qur'an learning, digital literacy, and religious assessment. European countries contributed 4 articles (10.8%), primarily on topics of international Research collaboration and hybrid curriculum development. Meanwhile, the "Others" category, which includes Southeast Asia excluding Indonesia and Malaysia, Africa, and North America, contributed 3 articles (8.1%) focusing on comparative studies and AI-PBL-based religious learning innovations.

### Bibliometric Findings (Collaboration, Visual Map)

A deeper analysis of the bibliometric results shows an increasingly broad pattern of collaboration among researchers, institutions, and countries in the development of AI and PBL integration Research in Islamic Religious Education (PAI). Data processed using VOSviewer software reveals several main collaboration clusters that play a role in the development and dissemination of Research in this field. From the authors' perspective, there are groups of researchers who consistently produce work related to the integration of technology and innovation in religious learning. Some university names in Indonesia, such as UIN Syarif Hidayatullah Jakarta, UIN Sunan Kalijaga Yogyakarta, and Universitas Pendidikan Indonesia, occupy central positions in the collaboration network. This collaboration is generally established through joint Research, international seminars, and publication of articles in reputable journals. The increase in international collaboration is also reflected in the many joint publications by Indonesian researchers with other Southeast Asian countries, as well as in the beginning of cooperation with countries in the Middle East and Europe, particularly in developing innovative AI-based learning models (Astuti *et al.*, 2025). These collaborations have produced findings showing a close connection among "artificial intelligence," "Islamic education," and "problem-based learning," as shown in **Figure 1**.



**Figure 1.** Visual Map of VOSviewer Analysis Results: Main Research Keyword Clusters (2020–2025)  
**Source:** 2025 Research

Thematically, the visual map (in **Figure 1**) identifies several key Research clusters. The first cluster focuses on the development of AI-based learning content and the digitization of Islamic Education teaching materials. The second cluster emphasizes implementing the PBL model to foster critical and collaborative thinking skills in religious classes. The third cluster combines both main themes, featuring Research that investigates how AI can support the application of PBL in religious learning, such as through chatbots, adaptive learning, and problem-based assessments (Astuti *et al.*, 2025). In addition, the network map shows the presence of central points, namely authors and institutions, with the highest number of publications and the most frequently cited as main references in this field. The high level of collaboration among these institutions indicates a shared awareness of the importance of developing innovative, adaptive, technology-based models of Islamic education. It can be concluded that the integration of AI and PBL in Islamic education is not only an individual Research focus but has developed into a joint movement through cross-institutional and cross-country collaboration. This collaboration pattern accelerates knowledge dissemination, best-practice exchange, and innovation development in Islamic education in the digital era.

### **Systematic Study (Synthesis of Findings)**

A systematic review of various national and international publications found that integrating AI and PBL into PAI has a significant positive impact on learning processes and outcomes. The literature synthesis shows that the application of AI in PAI learning is not limited to using digital applications as learning aids, but has evolved toward personalized materials, automated assessments, and even adaptive content development tailored to students' needs (Anwar, 2024). Beberapa temuan utama mengindikasikan bahwa penggunaan AI, seperti *chatbot* pendidikan, *learning analytics*, dan *adaptive learning systems*, mampu memberikan umpan balik instan dan personal kepada peserta didik. This capability enables teachers to monitor students' understanding of religious concepts, detect learning difficulties early, and adjust learning strategies based on students' learning profiles.

Meanwhile, PBL encourages students to actively solve real problems, engage in discussions, and think critically through contextual scenarios related to daily life and Islamic values (Alfaid & Hayani, 2024). The integration of AI and PBL in Islamic Religious Education (PAI) opens the door to a more participatory, collaborative, and project-based learning model. In several studies, this integration has been shown to improve learning motivation, understanding of religious concepts, and students' ability to apply Islamic values practically. For example, the use of AI-based applications in PAI learning can help students discuss real cases online, with an AI tutor that can respond to questions quickly and relevantly. Teachers serve as the primary facilitators, directing the flow of discussion, emphasizing spiritual aspects, and ensuring the achievement of religious learning objectives.

Furthermore, the synthesis results show that collaboration among teachers, students, and technology (AI) is crucial to ensuring the success of this integration. Teachers must be able to adapt to technological developments and possess adequate digital competence to manage AI-PBL-based learning. On the other hand, character development and religious values remain a top priority, so the use of technology is carried out without neglecting ethical and pedagogical aspects in Islamic religious education (Jannah *et al.*, 2023). From this synthesis, it can be concluded that the planned and systematic integration of AI and PBL can improve the effectiveness of PAI learning. However, the success of its implementation largely depends on human resource readiness, technological infrastructure, and commitment to maintaining a balance between digital innovation and Islamic values (Latifah & Ngalmun, 2023).

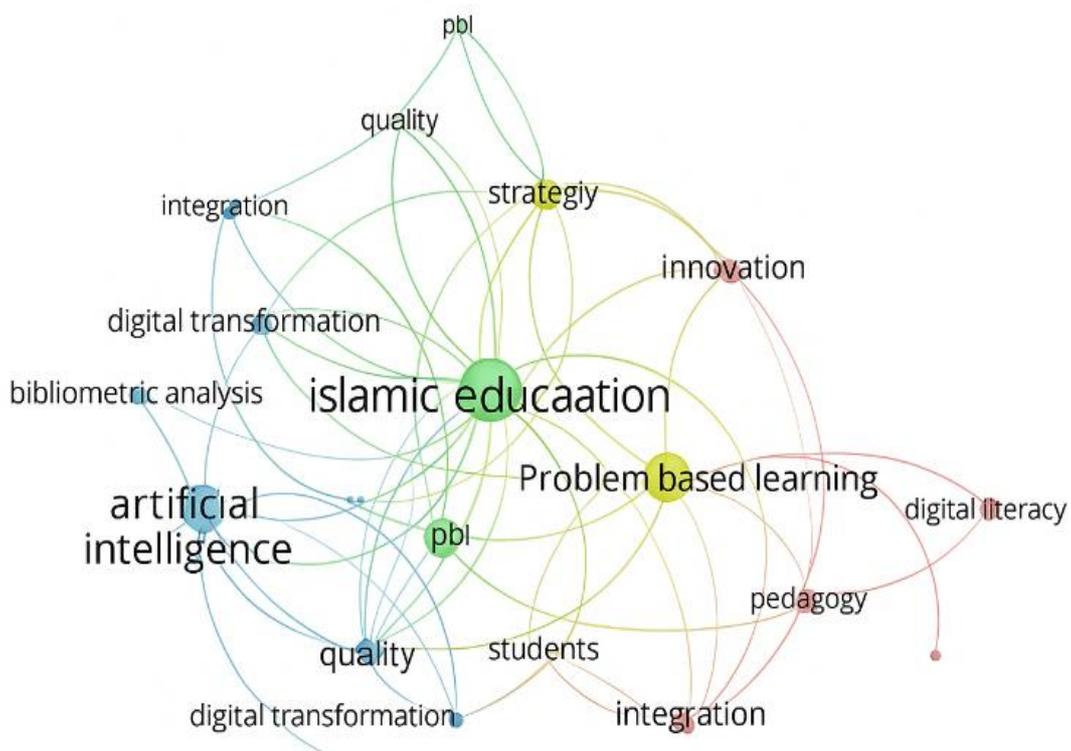
### **Systematic Study (Model/Implementation)**

Based on a systematic study, several effective models for integrating AI and PBL were identified to enhance the quality of Islamic Education (PAI) learning. These models are generally designed to optimize the advantages of artificial intelligence technology while reinforcing the pedagogical values of PBL in shaping students' character and competencies (Jannah *et al.*, 2025). One of the most widely adopted models is the Hybrid AI-PBL Classroom, a blended learning approach that combines face-to-face instruction, digital platforms, and AI tools. In this model, the learning process begins with the presentation of real-life problems (real cases) relevant to daily life and Islamic values. Students are then encouraged to analyze, discuss, and solve these problems in groups, both directly in class and through online discussion forums facilitated by AI-based chatbots or tutoring applications.

AI technology functions as a digital assistant that provides additional explanations, offers references, and automatically monitors students' learning progress (Salsabila *et al.*, 2022). The implementation of this model also demonstrates effectiveness in both formative and summative assessments. The AI system can automatically evaluate students' answers, assess their understanding, and recommend personalized remedial materials. In this case, teachers act as facilitators who integrate AI analysis results into learning strategies while ensuring that discussions remain aligned with religious education objectives and the strengthening of Islamic character (Tanjung & Suteki, 2024). Examples of best-practice applications can

be found in several madrasahs and schools in Indonesia that have developed PAI Smart Class, where teachers use AI-based applications to support thematic learning, digital classroom management, and competency assessment. Students are encouraged to work on collaborative projects addressing socio-religious issues, with AI guidance in finding literature sources, validating data, and designing creative solutions. In addition, AI-based reporting systems also facilitate real-time monitoring of student progress by teachers and parents (Annisa *et al.*, 2024).

The success of implementing the AI-PBL integration model heavily depends on the readiness of the technology infrastructure, teacher training in using AI, and support from educational institutions. The studies analyzed also emphasize the importance of developing an adaptive curriculum and regulations governing the ethical use of technology in religious education. Implementing this model, besides enhancing learning effectiveness, also strengthens collaboration between schools, families, and communities in shaping a generation of Muslims who are critical thinkers, innovative, and morally upright in the digital era (Rozi *et al.*, 2024). From these findings, it can be concluded that the integration model of AI and PBL not only improves the quality of Islamic education learning but also provides practical solutions to the challenges of learning in the era of digital transformation (Rodiyah, 2022).



**Gambar 2.** Peta Visual Hasil Analisis Hasil Bibliometrik (2020-2025)  
*Sumber: Penelitian 2025*

The bibliometric map (Figure 2) shows that each node represents a main keyword frequently used in related publications, such as “Islamic education”, “artificial intelligence”, “problem-based learning”, and “digital transformation”. The lines connecting the nodes illustrate the association or co-occurrence relationships between keywords within a single article. The thicker the line, the more often the two keywords appear together in a publication. The color and size of the clusters indicate the dominant Research themes, with “Islamic education” at the center and strong connections to “artificial intelligence”, “problem-based learning”, “digital literacy”, and “digital transformation”. This pattern indicates that the

Research trend on this topic is closely related to issues of technology-based learning innovation, digital literacy development, and the use of AI to enhance the quality of Islamic Education (PAI) learning.

## **Discussion**

### **Analysis and Implications**

The results of the bibliometric review and systematic study in this Research indicate that integrating AI and PBL has great potential to revolutionize PAI learning. Analysis of trends and implementation models developed shows that AI functions not only as a technical aid but also as a strategic partner in facilitating active, contextual, and personalized learning processes. The presence of AI provides opportunities for teachers and students to access a wide range of learning resources, receive instant feedback, and adjust the pace and depth of learning according to each individual's needs (Irnawati et al., 2021). From a pedagogical perspective, the combination of AI and PBL can drive a transformation in the learning paradigm from teacher-centered to student-centered. Students are not only recipients of knowledge but also active subjects who build understanding through problem-solving, collaborative discussions, and technology-based knowledge exploration.

PBL supported by AI is capable of expanding creative space, honing critical thinking skills, and instilling Islamic values through authentic learning experiences that are relevant to real life (Irnawati et al., 2021). The practical implication of this finding is the need for systemic support from various parties to ensure the successful implementation of AI-PBL integration in religious education settings. Teachers are required to have adequate digital competence, innovative pedagogical skills, and an adaptive attitude toward technological changes. The development of a curriculum that supports problem-based learning with AI should be promoted by educational institutions and the government, including the provision of equitable technological infrastructure and ongoing training for educators. On the other hand, clear regulations that promote the ethical use of technology in religious education are also very important to prevent misuse and uphold moral values in the learning process (Nasir et al., 2023).

Theoretically, this study contributes to the literature on digitally based Islamic education. The integration of AI and PBL enriches the body of modern pedagogical theory, particularly concerning innovative learning models that are adaptive to contemporary developments. This study also opens opportunities for further Research on the long-term impact of AI utilization on students' character and spirituality, as well as the effectiveness of various technology integration models across different contexts and levels of Islamic education. Future studies are recommended to expand the data sources by including more international databases, thereby making the literature more representative and global. The integration of AI and PBL is not merely a temporary trend but a strategic necessity to enhance the quality and competitiveness of Islamic education in an increasingly complex era of globalization and digitalization (Mutiarra, 2023).

### **Comparison and Suggestions**

The findings of this study align with previous Research highlighting the important role of digital technology, particularly artificial intelligence (AI), in supporting learning innovation in Islamic education. Previous studies emphasize that the application of AI in education, whether as an assessment tool, in the development of digital content, or as a learning companion through chatbots, can enhance access, effectiveness, and personalization of the learning process. Similarly, Problem-Based Learning (PBL) is consistently recognized as effective in developing students' critical thinking, collaboration, and problem-solving skills (Mutiarra, 2023). However, the integration of AI and PBL together in the context of Islamic Religious Education is still relatively new. It has not been widely discussed in either international or national

literature. Unlike conventional approaches that treat technology merely as a supplement, this study emphasizes that AI can be directly integrated into the PBL model, from problem formulation, information searching, solution discussions, to assessment and reflection on learning outcomes. This integration opens the door to developing a learning model that is more adaptive, responsive, and relevant to the characteristics of today's learners, who are very familiar with digital technology (Priatna, 2018).

A practical suggestion is to strengthen digital competency training for Islamic Education teachers so they can effectively develop, manage, and evaluate AI-PBL-based learning. In addition, educational institutions and the government need to develop an adaptive curriculum that facilitates the use of AI in project-based learning (PBL), including providing adequate technological infrastructure and regulatory support related to the ethical use of AI in religious education. Cross-institutional and international collaboration can also be continuously enhanced to broaden the exchange of experiences, best practices, and innovations in Islamic education learning models globally (Yasmansyah & Zakir, 2022). Theoretically, the results of this study open the door to further Research, particularly on the long-term impact of AI-PBL integration on the formation of Islamic character, the enhancement of religious digital literacy, and the development of students' social-spiritual competencies. Future Research can also examine various implementation model variants at different educational levels, including analyzing supporting and inhibiting factors from cultural, social, or policy perspectives (Hafidh *et al.*, 2023). The development of an AI and PBL integration model in Islamic Religious Education requires a unified alignment of pedagogical innovation, strengthening human resource competencies, and adaptive regulations to create an innovative, relevant, and sustainable religious learning ecosystem in the digital era (Kusumah *et al.*, 2025).

## CONCLUSION

This study comprehensively analyzes the integration of artificial intelligence (AI) and the Problem-Based Learning (PBL) model to improve the quality of Islamic Religious Education (PAI) in the digital era. Based on bibliometric results, Research trends on this topic show a significant increase, especially in 2024, alongside the acceleration of education digitalization and the need for adaptive religious learning innovations. The study found that integrating AI and PBL can enhance various aspects of PAI learning. AI plays an important role in providing personalized, adaptive learning experiences and in supporting automated assessment and real-time monitoring of students' progress. Meanwhile, PBL has been proven effective in enhancing students' critical thinking, collaboration, creativity, and problem-solving skills in a religious context. Systematic analysis results also identified several effective implementation models, such as AI-PBL-based hybrid classrooms and the use of chatbots or digital tutor applications to support collaborative learning. The readiness of the technological infrastructure greatly influences the success of this integration, teachers' digital competencies, the adaptive curriculum, and the ethical regulations that support learning innovation. Although this study has provided a comprehensive overview of the integration of AI and PBL in Islamic Education, several limitations remain that offer opportunities for further Research. Subsequent studies can empirically examine the effectiveness of implementing the AI and PBL integration model through experimental studies across various educational levels, including madrasahs, schools, and higher education institutions. Future Research could examine more deeply the impact of AI and PBL integration on character development, religious digital literacy, and ethical and pedagogical aspects of Islamic religious education. The development of digital-based learning evaluation instruments, longitudinal analysis of changes in teacher and student competencies, and cross-cultural or international comparative studies are also relevant topics to explore. Future studies are expected to enrich the body of knowledge and make a tangible contribution to the development of innovations in Islamic religious education in the digital era.

## AUTHORS NOTE

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