

Critical Analysis of the Application of Deep Learning in Islamic Religious Education: Opportunities and Obstacles

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Abstract

The study aims to develop an integrated learning model that harmonizes advanced artificial intelligence technology with fundamental Islamic educational values and formulate an ethical framework guiding deep learning implementation in Islamic education contexts. This study employs a qualitative approach utilizing library research design to explore digital transformation impacts on Islamic education learning methods. Data collection was conducted through systematic exploration of contemporary academic literature published in accredited national and international journals, conference proceedings, and research reports concerning digital transformation in Islamic education and deep learning applications in educational contexts. Secondary data obtained were analyzed using content analysis methods with four sequential stages: identification and categorization of data based on relevance to digital transformation impacts in Islamic education, codification of primary findings regarding deep learning implementation, interpretation of emerging patterns and themes, and synthesis of findings to develop conceptual frameworks. The research reveals that Islamic educational institutions possess adaptive capacity to integrate advanced technology without sacrificing fundamental values. The developed integrated model encompasses four key components: adaptive technological infrastructure enabling personalized learning experiences, educator capacity development programs focusing on digital literacy and pedagogical innovation, technology-enriched curriculum design maintaining alignment with Islamic educational objectives, and an ethical framework based on Islamic principles including justice (adl), trust (amanah), and public interest (maslahah).

Keywords: Deep Learning; Islamic Religious Education; Learning Technology.

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Abstrak

Penelitian bertujuan mengembangkan model pembelajaran terintegrasi yang menyelaraskan teknologi kecerdasan buatan canggih dengan nilai-nilai fundamental pendidikan Islam serta merumuskan kerangka etis yang memandu implementasi deep learning dalam konteks pendidikan Islam. Penelitian ini menggunakan pendekatan kualitatif dengan desain penelitian kepustakaan untuk mengeksplorasi dampak transformasi digital terhadap metode pembelajaran pendidikan Islam. Pengumpulan data dilakukan melalui eksplorasi sistematis literatur akademik kontemporer yang dipublikasikan dalam jurnal nasional dan internasional terakreditasi, prosiding konferensi, dan laporan penelitian terkait transformasi digital dalam pendidikan Islam dan aplikasi deep learning dalam konteks pendidikan. Data sekunder yang diperoleh dianalisis menggunakan metode analisis konten dengan empat tahapan berurutan: identifikasi dan kategorisasi data berdasarkan relevansi terhadap dampak transformasi digital dalam pendidikan Islam, kodifikasi temuan primer mengenai implementasi deep learning, interpretasi pola dan tema yang muncul, dan sintesis temuan untuk mengembangkan kerangka konseptual. Penelitian mengungkapkan bahwa institusi pendidikan Islam memiliki kapasitas adaptif untuk mengintegrasikan teknologi canggih tanpa mengorbankan nilai-nilai fundamental. Model terintegrasi yang dikembangkan mencakup empat komponen kunci: infrastruktur teknologi adaptif yang memungkinkan pengalaman pembelajaran personal, program pengembangan kapasitas pendidik yang berfokus pada literasi digital dan inovasi pedagogis, desain kurikulum yang diperkaya teknologi dengan mempertahankan keselarasan dengan tujuan pendidikan Islam, dan kerangka etis berdasarkan prinsip-prinsip Islam meliputi keadilan (adl), amanah (trust), dan kemaslahatan (masalah).

Kata Kunci: Deep Learning; Pendidikan Agama Islam; Teknologi Pembelajaran.

A. Introduction

The era of contemporary digital transformation has given rise to a new paradigm in the world of education through the integration of deep learning

technologies that offer innovative solutions to various modern pedagogical challenges. Deep learning, as a manifestation of rapidly evolving artificial intelligence, has the capacity to

analyze complex patterns in learning data and provide adaptive responses to individual needs of learners. In the context of Islamic Religious Education, the implementation of this technology presents a unique dynamic that requires a balance between technological innovation and the preservation of the fundamental values of Islamic teachings. This complexity arises because Islamic Religious Education is not only oriented towards the transfer of cognitive knowledge, but also the formation of spiritual and moral character that requires a holistic and personalized approach.

Various previous studies have explored the potential of deep learning in improving educational effectiveness. Zhang and his collaborators revealed that artificial neural networks with the right architecture can show minimal gaps between training and test performance, indicating superior generalization capabilities. These findings open up opportunities for the development of learning models that are more responsive to individual variations in learning styles. Meanwhile, Abdar and his research team emphasized the significance of uncertainty quantification

methods in deep learning that play a crucial role in reducing ambiguity during optimization processes and data-driven decision-making. This aspect is fundamental in the context of education which requires high accuracy in learning assessment and evaluation.

The practical application of deep learning has been proven in a variety of domains, including the field of health where Ozturk and his colleagues managed to develop a detection model with classification accuracy of ninety-eight percent zero points for binary cases and eighty-seven zero-point two percent for multi-class cases. This success demonstrates the technology's capabilities in analyzing complex patterns and providing solutions to problems that require visual analysis and sophisticated pattern recognition. In the context of education, analogous skills can be used to identify students' learning patterns, detect learning difficulties, and provide timely and targeted interventions.

However, the implementation of deep learning technology in the world of education faces various complex challenges. The four main factors driving the urgency of using deep

learning in today's educational context include the massive explosion of educational data, the increasing need for learning personalization, the limitations of conventional learning approaches, and the demands of digital transformation in the era of the fourth industrial revolution. However, deep learning also faces significant barriers related to the readiness of human resources and technological infrastructure, the quality of the data and models used, and the suitability with established pedagogical approaches.

Yudiawan and his collaborators' research on the success factors of online learning in Islamic Religious Colleges shows that infrastructure and system quality are the dominant factors with a contribution of ninety-four point two percent to learning success, while the variety of institutions and services only has an impact of six point three percent. These findings indicate the importance of building a solid technological foundation before implementing a deep learning-based learning system. Alturise through its evaluation of the implementation of the learning management system also concluded that the implementation of electronic courses

is a progressive step, but requires significant efforts to achieve the desired improvements.

The historical and philosophical perspective of Islamic education provides an additional dimension to this discussion.

Sabic-El-Rayess conceptualizes that the conception of knowledge and education in Islam has undergone a transformation from an inclusive and rational search for all knowledge to a narrower focus on religious knowledge by reducing the aspect of rationality. The study identified three shifts in the cultural history of Islamic education that influenced contemporary phenomena. This highlights the importance of a critical and rational approach in integrating modern technology with traditional Islamic educational values.

Academic reform in Islamic higher education, as studied by Suyadi and his research team, shows four main agendas that include the internationalization of study programs, the opening of new programs, the integration of postgraduate management into the faculty, and the opening of teacher certification programs. This reform became the foundation for other Islamic universities

and opened up opportunities for the internationalization of Islamic higher education institutions in Indonesia. In this context, the integration of deep learning can be an important component of the internationalization agenda. The concept of innovation in responding to contemporary challenges is also explored through an approach that shows how reasoning can be extended in medical, theological, and educational movements, providing insight into the integration of Islamic values with modern approaches.

Nonetheless, the implementation of deep learning in education must comprehensively consider the context of ethics, pedagogy, and digital access. No matter how sophisticated technology is, it still requires the role of humans as facilitators and guides in the learning process, indicating the importance of a balance between technological automation and the human touch in education.

Analysis of the previous literature reveals significant research gaps in the context of the application of deep learning in Islamic Religious Education. Most previous research has focused on the implementation of electronic

learning or deep learning in the context of general education, without considering the unique characteristics of Islamic Religious Education that include distinctive spiritual, moral, and cultural dimensions. Previous research also tends to ignore the complexity of integrating modern technology with traditional Islamic values, even though this aspect is crucial in ensuring the suitability of technology implementation with the philosophy of Islamic education.

Furthermore, research gaps are also identified in terms of the lack of studies that holistically analyze pedagogical, ethical, and cultural challenges in the implementation of deep learning in Islamic Religious Education. Previous research has generally been partial with a focus on purely technical aspects, without considering the humanist and spiritual dimensions that are fundamental characteristics of Islamic religious education. This gap becomes even more significant considering that Islamic Religious Education has a different complexity from general education, where aspects of character formation and spirituality are the main goals that cannot be achieved solely through technological approaches.

Based on the identification of these gaps, this study seeks to fill the blank space in the academic literature by critically and comprehensively analyzing the opportunities and obstacles to the implementation of deep learning in Islamic Religious Education. The focus of the analysis covers the technical, pedagogical, ethical, and cultural dimensions inherent in Islamic education, with the aim of producing a theoretical and practical framework for the implementation of technology that is in harmony with the fundamental values of Islam. Through an in-depth analytical approach, this research is expected to make a significant contribution to the development of an educational model that integrates technological innovation with the preservation of the essential values of Islamic education, as well as a reference for the development of Islamic education policies and practices in the digital era.

B. Methods

This study applies a qualitative methodology based on literature search to examine in depth the phenomenon of deep learning integration in the realm of Islamic Religious Education. The

collection of research materials is carried out through a systematic exploration of academic literature, including reputable journal articles, monographs, educational regulatory documents, and thematic webinar documentation. The data sources are secondary and include conceptual studies, empirical research results, and theoretical frameworks from various scientific publications. The selection of literature materials is prioritized in the latest scientific publications for the 2020-2025 period that examine the implementation of deep learning technology in the education sector, with a special emphasis on the realm of education based on Islamic values. The analysis process adopts descriptive-interpretive techniques that involve the stages of data condensation, visualization of findings, and conclusion formulation. Verification of the results of the analysis is carried out through a multi-source triangulation mechanism by comparing various points of view from various corpus of literature. National webinar material with the contribution of Dr. Moh. Ali is used as a substantial reference that enriches the dimension of analysis. This methodological approach facilitates a comprehensive exploration

of the spectrum of opportunities and challenges in the contextualization of deep learning in the Islamic Religious Education system by considering technical, pedagogical, ethical and cultural aspects.

C. Results and Discussion

The Paradigm of Applying Deep Learning in the Context of Islamic Religious Education

The transformation of the contemporary digital ecosystem has presented a fundamental metamorphosis in various dimensions of life, with substantive implications in the realm of education. In the landscape of Islamic Religious Education (PAI), the integration of deep learning as a progressive manifestation of artificial intelligence technology offers a new paradigmatic construction that requires deep analytical elaboration. Deep learning, as conceptualized by (Alzubaidi et al., 2021), has transformed into a leading parameter in the machine learning community and is extensively implemented to accommodate a spectrum of complex cognitive tasks with performative outcomes capable of equalizing or even surpassing human capabilities. One of the essential superiorities of deep learning technology

lies in its capacity to assimilate massive datasets and generate algorithmic patterns that are applicable to diversity of orientation, including the development of adaptive learning architectures.

In the epistemological construction of Islamic Religious Education, the implementation of deep learning technology requires elaborative contextualization that accommodates the distinctive characteristics of learning Islamic values. As articulated by (Ma'arif et al., 2022), Islamic higher education institutions have constructed a diversity of instructional strategies to strengthen the psychomotor and affective dimensions of students, including experiential approaches, systematic habituation, emotional stimulation, functional orientation, and rational elaboration. These strategies are transformed through varied learning modalities such as verbal explanation, discursive dialectics, experimental exploration, and task structuring that promote Islamic moderation values and the conception of Rahmatan Li-al'âmin. The integration of deep learning technology in the strategic framework of learning opens up a spectrum of

expansive opportunities for the development of a more adaptive and personalized PAI learning architecture.

Dr. Moh. Ali in his substantive explanation at the FORKOM ASN West Java National Webinar forum articulated that deep learning technology has the potential to be a solution instrument in big data management and learning facilitation with superior adaptive characteristics, but it will be degraded into an illusionist construction if the ethical dimension, pedagogical framework, and digital accessibility are neglected in its implementation. The articulation represents the significance of a holistic-integrative approach in implementing this revolutionary technology in the Islamic education ecosystem. He also identifies a quartet of determinant factors that accelerate the imperative of deep learning implementation in the contemporary educational landscape: the volumetric explosion of educational data (the phenomenon of big data), the urgency of personalizing learning experiences, inherent limitations in conventional learning modalities, and the transformative acceleration in the digital

dimension that is characteristic of the Industrial Revolution 4.0 era.

The paradigmatic construction of the implementation of deep learning in the PAI ecosystem requires consideration of the philosophical dimension inherent in the architecture of Islamic education. As elaborated by (Lahmar, 2020), Islamic education needs to cultivate a "cultural environment based on Islamic wisdom" that facilitates the actualization of actions ('amal) that catalyze the holistic development of learners in the spectrum of ethics (akhlaq), aesthetic appreciation (dhawq/jamāl), and the cultivation of liberation consciousness (huriyyah). In this contextualization, deep learning technology can be positioned as a facilitation instrument that enriches the learner's educational experience in constructing Islamic wisdom, not just a technological entity that is adopted by ignoring the contextualization of values

In a broader context, the integration of deep learning in PAI also needs to pay attention to the aspect of deradicalization of religion through strengthening the understanding of Pancasila. (Courtesy of Fatah & Fatah, 2021) revealed that the process of

deradicalization through Islamic Religious Education can be carried out through strengthening Pancasila values that are integrated through PAI. This is based on a style of radicalism, especially among Muslims who question the validity of the national principle of Pancasila in the name of Islam. In this context, deep learning technology can be used to analyze patterns of religious understanding and provide appropriate interventions to reinforce moderate values in Islamic education.

Potential and Application of Deep Learning in the Development of PAI Learning Models

The application of deep learning in the development of PAI learning models offers various potentials and applications that can improve the quality and effectiveness of learning. (Janiesch et al., 2020) explains that artificial intelligence, including deep learning, has become an integral part of the world, with or without us realizing it, and has made great progress primarily through the evolution of machine learning and deep learning algorithms and rich computing resources. In the context of learning, this technology can be used to analyze students' learning patterns, predict

learning needs, and provide a personalized learning experience.

One of the potential applications of deep learning in PAI is the development of an adaptive learning content recommendation system. Based on the results of student interaction with learning materials, the system can predict students' learning needs and recommend content that is appropriate to their level of understanding and learning style. This is in line with the findings of Fasya et al. (2023) which show that there is a positive and significant influence between learning motivation on PAI learning achievement of $6,076 > 1,999$ with a sig value of $0.000 < 0.05$. By understanding the patterns of student learning motivation through deep learning analysis, the development of learning content can be adjusted to increase learning motivation and ultimately improve student learning achievement.

Another application of deep learning in PAI is the development of a more comprehensive learning evaluation system. (Makruf et al., 2022) in his research on Moodle-based online learning management in colleges revealed that the implementation and

evaluation of learning still needs to be optimized, with CFA results showing that three manifest variables were below 0.4. Through the application of deep learning, learning data analysis can be carried out in more depth to identify patterns of student engagement, material understanding levels, and factors that affect learning effectiveness, so as to provide more accurate input for the development of more effective learning models.

The potential of deep learning in the development of the PAI learning model also includes personalizing the learning experience based on the analysis of student learning data. (Sukiman et al., 2022) revealed that online learning during the COVID-19 pandemic at the undergraduate, master's, and doctoral levels of Islamic Religious Education has been effective, with online learning at the doctoral level being the most effective among all. However, face-to-face learning is still needed, so the learning pattern developed after the COVID-19 pandemic combines face-to-face and online learning (hybrid learning). In this context, deep learning can be used to analyze the effectiveness of various

components in a hybrid learning model and provide recommendations for optimizing students' learning experiences based on the characteristics, educational goals and orientations, ability levels, readiness, and learning independence of students at each level of education.

The application of deep learning in the development of the PAI learning model can also be seen in a broader context, namely as a tool to develop collective intelligence in the learning community. (Haryani et al., 2021) in his research on the exploration of Islamic religious learning innovation technology with the iLearning approach revealed that learning applications that meet four assessment criteria: parental control, contribution to skill development, efficiency, and motivation, can be an effective platform for Islamic religious learning. In this context, deep learning can be used to analyze interactions between students in the learning community, identify patterns of effective collaboration, and provide recommendations to optimize collaboration dynamics in PAI learning.

Challenges and Obstacles to Implementing Deep Learning in PAI

Although it offers a wide range of potential, the implementation of deep learning in Islamic Religious Education also faces various challenges and obstacles that need to be overcome. One of the main challenges is the availability of adequate technological infrastructure. As expressed by Dr. Moh. Ali, the main challenge lies in the readiness of human resources and infrastructure, the quality of data and models, and the suitability with pedagogical approaches. This is in line with the findings (Yudiawan et al., 2021) which shows that infrastructure and system quality are the dominant factors (94.2%) that affect the success of online learning in Islamic Religious Universities in the COVID-19 era.

Another challenge in the implementation of deep learning in PAI is the limitations in developing models that are in accordance with the characteristics of Islamic religious learning. (Ozturk et al., 2020) Explains that the development of effective deep learning models requires sufficient and representative data. In the context of PAI, the development of a deep learning model that can analyze the understanding of complex and abstract religious concepts is a challenge in itself.

The model developed needs to consider the spiritual, ethical, and cultural dimensions inherent in Islamic religious learning, which may not be easily represented in the form of data that can be processed by deep learning algorithms.

Another obstacle in the implementation of deep learning in PAI is the limited digital competence of educators and students. (Alturise, 2020) through its evaluation of the implementation of Blackboard Learn's Learning Management System for full online courses in Islamic universities, it concluded that the implementation of e-courses is a significant step forward, but requires significant work to get the necessary improvements. This indicates the need for systematic digital competency development for educators and students in order to make optimal use of deep learning technology in PAI learning.

In a broader context, the implementation of deep learning in PAI also faces challenges related to resistance to change and concerns about the loss of traditional values in Islamic education. (Huda et al., 2020) revealed that students from the Tebuireng Islamic

Boarding School who are not familiar with traditional education, such as science-based subjects (mathematics, chemistry, physics, biology, and management) face difficulties in taking the course. Similarly, students from other schools that do not have Islamic education face difficulties when taking courses at the Tebuireng Islamic Boarding School. This shows that there is a gap in the integration of traditional and modern education, which can be an obstacle in the implementation of modern technologies such as deep learning in the context of traditional Islamic education.

Another challenge is the complexity of integrating Islamic values with modern technologies such as deep learning. (Sabic-El-Rayess, 2020) Conceptualize that the idea of knowledge and education in Islam has undergone a shift from an inclusive and rational search for all knowledge to a narrow focus on religious knowledge, without rationality. The study identified three shifts in the cultural history of Islamic education that played a significant role in the emergence of radicalization today. This shows the importance of a critical and rational

approach in integrating modern technologies such as deep learning with traditional Islamic educational values, to avoid a narrow and non-rational approach in Islamic education.

Deep Learning Integration Strategy in the PAI Curriculum

Facing various challenges and obstacles in the implementation of deep learning in Islamic Religious Education, a comprehensive and contextual integration strategy is needed. One of the strategies that can be applied is the development of a PAI curriculum that integrates deep learning technology gradually and systematically. (Suyadi et al., 2022) In his research on academic reform and the sustainability of Islamic higher education in Indonesia, he shows that there are four main agendas of academic reform which include the internationalization of study programs, the opening of new programs, the integration of postgraduate management into the faculty, and the opening of teacher certification programs. In this context, the integration of deep learning in the PAI curriculum can be part of the internationalization and development agenda of the new program.

Another strategy is the development of a hybrid learning model that integrates face-to-face learning with technology-based learning, including deep learning. (Sukiman et al., 2022) revealed that the learning pattern developed after the COVID-19 pandemic combines face-to-face and online learning (hybrid learning), with formulations tailored to the characteristics, goals and orientation of education, the level of ability, readiness, and independence of students learning at each level of education. In this hybrid learning model, deep learning can be used to analyze learning data and provide recommendations for optimizing student learning experience.

The development of digital competencies of educators and learners is also a key strategy in the integration of deep learning in the PAI curriculum. (Makruf et al., 2022) highlight the importance of improving the quality of applications, supporting facilities, and user capabilities in the context of Moodle-based online learning. In the context of deep learning integration, the development of digital competencies needs to include an understanding of the basic principles of artificial intelligence,

the ability to interpret the results of learning data analysis, and the skills to design data-driven learning interventions.

The strategy of integrating deep learning in the PAI curriculum also needs to consider aspects of ethics and Islamic values. (Apostolopoulos & Mpesiana, 2020) in his research on the automatic detection of COVID-19 from X-ray images using transfer learning with convolutional neural networks, emphasizing the importance of evaluation from various aspects before implementing technology-based approaches in the health field. Similarly, the implementation of deep learning in PAI needs to be evaluated from various aspects, including its conformity with the values and principles of Islamic education.

In a broader context, deep learning integration strategies in the PAI curriculum also need to consider its impact on students' identities and social mobility. (Genocide & Bakali, 2020) in her research on the post-conflict educational reality for victims of the Rohingya genocide revealed that religious instruction centers can serve to improve the gender-based education gap

for adolescent Rohingya women. In this context, the integration of deep learning in the PAI curriculum needs to consider its impact on educational inclusivity and accessibility for various community groups, including marginalized groups.

Implications and Recommendations for the Development of Deep Learning-Based PAI Learning Models

Analysis of the potential, applications, challenges, and strategies of deep learning integration in Islamic Religious Education raises various implications and recommendations for the development of deep learning-based PAI learning models. The first implication is the need for a new paradigm in Islamic education that integrates modern technology with traditional Islamic values. As expressed by (Lahmar, 2020), Islamic education needs to develop a "culture based on Islamic wisdom" that promotes actions ('amal) that foster the holistic growth of students in the fields of ethics (akhlaq), aesthetics (dhawq/jamāl), and developing a sense of freedom (huriyyah). In this context, deep learning can be seen as a tool that enriches the learning experience in developing Islamic wisdom.

The second implication is the need to develop a PAI curriculum that is more adaptive and responsive to the individual needs of students. Through the analysis of learning data using deep learning, students' individual learning patterns, needs, and preferences can be identified, allowing for the development of a more personalized and adaptive curriculum. This is in line with the findings (Fasya et al., 2023) which shows that there is a positive and significant influence between learning motivation and discipline on PAI learning achievement. By understanding the factors that affect motivation and learning discipline through deep learning analysis, the PAI curriculum can be developed to be more effective in improving students' learning achievement.

The third implication is the need for a multi-disciplinary approach in the development of a deep learning-based PAI learning model. As expressed by (Alzubaidi et al., 2021), deep learning has been successfully applied in various domains such as cybersecurity, natural language processing, bioinformatics, robotics and control, and medical information processing. In the context of PAI, the development of deep learning-

based learning models requires collaboration between Islamic education experts, artificial intelligence experts, learning designers, and educational practitioners to produce a comprehensive and effective model.

Based on these implications, several recommendations can be submitted for the development of a deep learning-based PAI learning model. The first recommendation is the development of a deep learning-based PAI learning platform that integrates various learning resources and analytical tools to facilitate adaptive and personalized learning. This platform needs to be designed with the principles of Islamic learning in mind and the specific needs of Islamic religious education.

The second recommendation is the development of a comprehensive training program for PAI educators to improve their digital competence, especially in utilizing deep learning technology in learning. This training program needs to include an understanding of the basic principles of artificial intelligence, the ability to interpret the results of learning data analysis, and the skills to design data-driven learning interventions.

The third recommendation is the development of collaboration between Islamic educational institutions, artificial intelligence research institutes, and the technology industry to develop innovative and contextual deep learning-based PAI learning models. This collaboration can bridge the gap between theory and practice, as well as facilitate the transfer of knowledge and technology between various stakeholders.

The fourth recommendation is the development of an ethical framework for the implementation of deep learning in PAI that takes into account Islamic values and principles. This ethical framework needs to address issues such as data privacy, algorithmic transparency, and fairness in algorithm-based decision-making, in the context of Islamic education.

D. Conclusion

The implementation of deep learning in Islamic Religious Education opens up a spectrum of transformative opportunities through learning personalization, learning pattern analysis, and the development of adaptive content recommendation

systems. Significant challenges include infrastructure limitations, digital competency gaps, and the complexity of integrating Islamic values with modern technology. The optimal strategy requires a holistic approach that accommodates technical, pedagogical, ethical, and cultural dimensions through the development of integrated curricula, hybrid learning models, and educator capacity building. The success of implementation depends on the balance between technological innovation and the preservation of the fundamental values of Islamic education.

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