Digital transformation of Islamic education through deep learning in the postmodern era

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ARTICLE INFO

Article history
Received: April 24, 2025
Revised: June 2, 2025
Accepted: 3 June, 2025

Keywords
Islamic education
Digital transformation
Deep learning
Postmodern era

ABSTRACT

This study aims to examine the digital transformation of Islamic education through the application of deep learning technology in the postmodern era. The research method used a literature review guided by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). Articles were searched for using Google Scholar with specific keywords, yielding 95 initial articles. After the selection process (removal of duplicates, screening of titles and abstracts, and full-text assessment), only 5 articles met the inclusion criteria. Content analysis was conducted descriptively to identify the main themes. The results of the study found three important themes: (1) the integration of technology in Islamic education management, (2) the application of deep learning in Islamic learning, and (3) adaptive leadership in digital Islamic education. These findings confirm that deep learning can support personalized learning, strengthen education management, and encourage adaptive visionary leadership. However, this study also found limitations such as low digital literacy among educators and uneven infrastructure. The study concluded that deep learning-based digital transformation is not only a technological innovation but also a strategic step to maintain the relevance of Islamic values amid the progress of the times. Further research is recommended to expand the database, increase the number of literature analyzed, and test this conceptual model in an empirical context.

1. Introduction

The postmodern era is characterized by plurality of information, cultural dynamics, and technological acceleration that affect almost all aspects of human life, including education. One of the rapidly developing technologies is artificial intelligence (AI), and one of its branches, deep learning, has great potential in education. Deep learning is a part of AI that enables computer systems to learn complex data, recognize patterns, and make decisions automatically (Raup et al., 2022). This technology has been widely used in modern education systems, but has not been studied in depth in the context of Islamic education.

Islamic education has the primary mission of shaping people of noble character based on Islamic values (Iqbal et al., 2024). However, the challenges of globalization and digitalization require new strategies to remain relevant. The integration of deep learning in Islamic education can provide a more adaptive, personalized, and contextual learning model (Oktaviani, 2024). This is important considering that many Islamic educational institutions are still lagging behind in the use of technology (Munir & Su'ada, 2024). Therefore, this study focuses on exploring the potential and challenges of applying deep learning in the digital transformation of Islamic education in the postmodern era.

Deep learning is a branch of artificial intelligence (AI) that enables computer systems to learn from data automatically and make intelligent decisions. In the educational context, deep learning functions not only as a learning aid but also as a mechanism to understand students' learning behavior patterns, personalize learning content, and improve the efficiency of educational management. This technology has been widely applied in Western and modern educational systems, yet it has not been extensively discussed in the context of Islamic education. Deep learning-based AI technology is believed to help educational institutions increase efficiency, reduce operational costs, and enhance responsiveness to demand (Raup et al., 2022).

Islamic education possesses strong historical and philosophical values, supported by a rich scholarly tradition and the primary goal of shaping individuals with noble character. However, in facing the challenges of an ever-changing era, Islamic education is required to remain relevant without losing its identity. This is where digital transformation becomes essential as a strategy to bridge classical values with contemporary needs. Integrating deep learning into the Islamic education system is not only a form of technological innovation but also a response to the demands of the time (Nafsaka et al., 2023).

The integration of artificial intelligence (AI) in Islamic education has shown great potential in improving the quality of learning. One study highlights that AI can reinforce Islamic values through more personalized, effective, and adaptive learning. By utilizing AI, the evaluation process can be automated, and teaching materials can be tailored to student needs, thus supporting balanced spiritual and intellectual development (Hadziq et al., 2024). However, challenges such as the digital literacy gap among teachers and limited technological infrastructure are still obstacles to the optimal implementation of AI. Therefore, efforts are needed to strengthen digital literacy for educators as well as the development of ethical policies to ensure that the use of AI is in line with Islamic values (Jusman & Usman, 2025).

Ideally, Islamic education should be able to offer a dynamic, participatory, and technology-based learning model that supports both the spiritual and intellectual development of students in a balanced manner (Brutu et al., 2023). However, in reality, many Islamic educational institutions are still lagging behind in the optimal use of technology (Astuti et al., 2023). Learning processes tend to remain conventional, the use of technology is still limited, and there are few initiatives to systematically integrate AI into curricula or teaching methodologies. This gap becomes even more evident when compared to general educational institutions that have begun adopting smart learning systems, adaptive learning, and AI-based learning analytics. Islamic educational institutions both formal, such as madrasas and Islamic universities, and informal, such as pesantren still face challenges in accessing and implementing modern technology (Iris, 2025). One stated that the integration of technology in Islamic education faces infrastructure and student readiness challenges, although educators show high confidence in the benefits of technology for enhancing the teaching process (Mar, 2024).

The urgency of this research lies in the need to examine the potential and challenges of applying deep learning in Islamic education amid increasingly massive digital transformation. Integrating technologies such as deep learning into Islamic education is not only a form of innovation but also a timely response. Transformation of Islamic education in the digital era presents both opportunities and challenges in utilizing technology to instill Islamic values, emphasizing the need for relevant approaches to achieve understanding and practice of Islamic principles through technology. This research is also grounded in the awareness that Islamic education has a strategic role in instilling human values, religious moderation, and building a just civilization. Therefore, technologies like deep learning must not be left to develop freely without direction that aligns with the spirit of Islamic education (Mustofa et al., 2024). Islamic religious education plays a crucial role in shaping students' social and humanitarian awareness, which is a vital foundation in facing the challenges of globalization and digitalization. Thus, the integration of technology into Islamic education must consider ethical and spiritual dimensions as its core foundation (Jamil et al., 2023).

Furthermore, the integration of deep learning into Islamic education opens up significant opportunities to develop personalized, contextual, and data-driven learning models. This technology can be used to analyze students' learning styles, provide automated feedback, and create more inclusive and flexible learning systems. Use of artificial intelligence (AI)-based technology in Islamic religious education can enhance the personalization of learning materials, expand

accessibility, and provide a more meaningful learning experience for students. This aligns with the spirit of Islam, which places knowledge as a means to draw closer to Allah and to build a knowledgeable and morally upright society (Nurhayati et al., 2024).

Nevertheless, there is still a lack of scholarly research that specifically discusses the relationship between deep learning and Islamic education from the perspective of digital transformation. Most studies are still limited to general uses of technology or only at the level of digitalizing administrative processes in education. Yet, the challenges of postmodernism demand a deeper approach to revitalize the Islamic education system so that it does not fall into stagnation. Therefore, this literature review is important to map out the potential of integrating deep learning into Islamic education while also identifying challenges and strategic steps that can be taken. By reviewing related literature, it is expected that a relevant and applicable conceptual framework can be found to meet the needs of Islamic education in the digital era.

The main objective of this research is to explore in depth how deep learning can contribute to the digital transformation of Islamic education in the postmodern era. Additionally, this study aims to enrich the body of knowledge regarding technological approaches in Islamic education and serve as a reference for Islamic educational institutions in developing digitalization strategies aligned with Islamic values. Therefore, the findings of this study are expected to offer both theoretical and practical contributions in promoting the modernization of Islamic education without losing its identity. Digital transformation through deep learning is not only about technological advancement but also about maintaining Islamic values in an ever-evolving education system (Rahma & Mufidah, 2025).

2. Method

2.1 Research design

This study uses a literature review method to evaluate and interpret various research findings that have been published in scientific journals, enabling researchers to identify patterns, trends, and interconnections between topics in a particular field based on relevant literature reviews. Through systematic review, this study is expected to provide a clearer picture of the dynamics of research development, such as popular themes, approaches used, and strategies for integrating deep learning technology in Islamic education in the digital age.

Furthermore, this literature review emphasizes the importance of critically examining selected sources to ensure they are not merely descriptive but also analytical and evaluative. With this approach, this research is expected to uncover existing research gaps and provide both theoretical and practical contributions to the development of Islamic education in the digital era. This critical review focuses not only on identifying trends in research themes and approaches but also on how the results can provide concrete implications in the context of learning, curriculum, and digital technology integration. Thus, this research serves not only to summarize previous research findings but also to open up space for the development of new ideas that are more relevant to the needs of Islamic education in the Industrial Revolution 4.0 era.

To ensure transparency and systematic procedures in the research process, this study adopts the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model guidelines. The PRISMA model provides a detailed description of the stages of the research process, starting from the identification of data sources, selection of relevant literature, to the screening of articles based on predetermined inclusion and exclusion criteria (Moher et al., 2009; Page et al., 2021). This process helps maintain the quality and validity of the research, and the results of the article selection process are visualized in the PRISMA diagram (Figure 1).

The PRISMA diagram in Figure 1 contains four main phases, namely identification, screening, eligibility, and inclusion. In the identification phase, all articles were obtained through the Google Scholar database using predetermined keywords. Next, in the screening stage, duplicate and irrelevant articles were eliminated. The eligibility stage was carried out by assessing the full text of each article based on predetermined inclusion and exclusion criteria. Ultimately, five articles met the criteria and were included in the final analysis of this study.

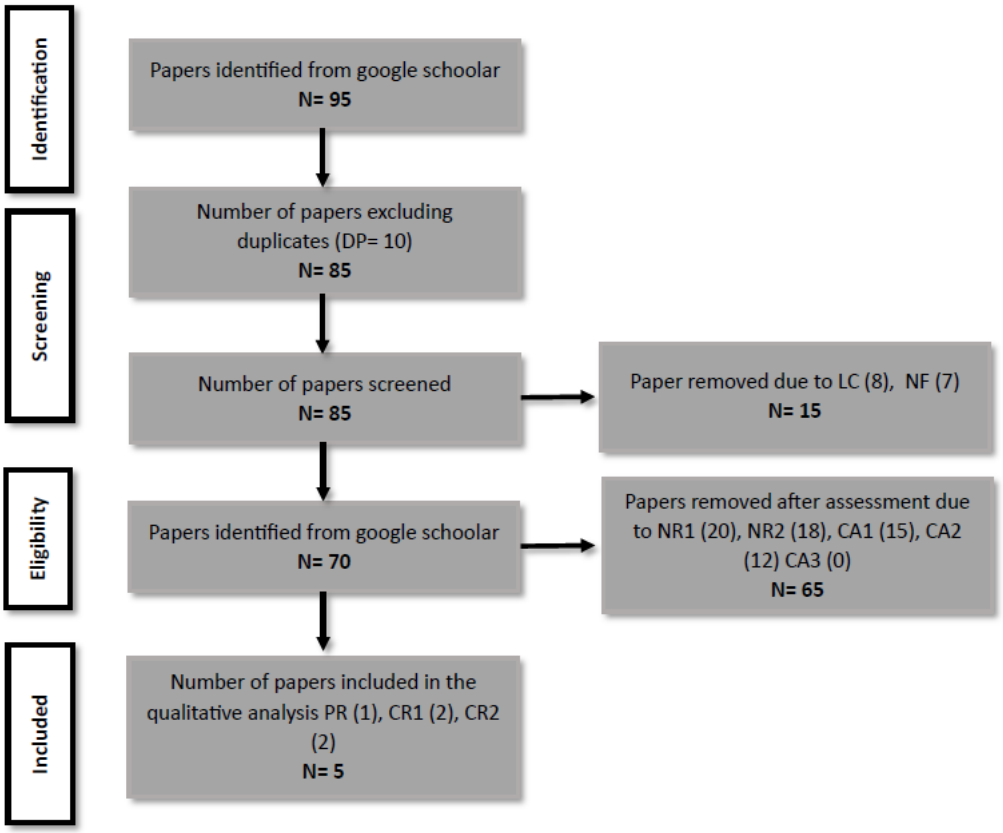

Fig. 1. PRISMA diagram

2.2 Data extraction

The research population consists of literature discussing the integration of technology, particularly artificial intelligence and deep learning, in education systems with a focus on Islamic education, while the research sample includes journal articles, seminar proceedings, and other relevant academic sources. The data extraction process was carried out using inclusion and exclusion criteria; the inclusion criteria included literature that directly discussed Islamic education, the application of deep learning or artificial intelligence in the context of education, and was published within a period relevant to the development of digital technology. Meanwhile, exclusion criteria included literature that was merely opinion without scientific basis, not available in full text, irrelevant to the theme of Islamic education, or discussed technology unrelated to deep learning. Thus, the extracted data focused on the concepts, implementation, challenges, and strategies for integrating deep learning into Islamic education in accordance with the research objectives.

2.3 Data collection tools.

The data collection tools in this study consisted of literature searches through academic databases, particularly Google Scholar, which were used to identify journal articles, proceedings, and other scientific sources relevant to the research topic. The search results were then recorded in the form of analytical notes compiled by the researchers to summarize, organize, and highlight important information from the collected literature. These analytical notes serve as the main instrument in data processing, facilitating further analysis.

2.4 Research procedure

The research procedure was carried out through a documentation study with several stages, namely identifying relevant literature, selecting sources based on criteria of thematic relevance and credibility, analyzing the content of literature discussing the implementation of deep learning in Islamic education, and compiling the results of the study in the form of a structured narrative. Of the 95 articles identified through Google Scholar, 10 articles were removed due to duplication, leaving 85 articles for the screening stage. At the title and abstract screening stage, 15 articles were excluded (context not relevant to Islamic education = 8; full text not available = 7), leaving 70 articles to be

assessed in full text. After full-text assessment, 65 articles were excluded with the following details: not relevant in terms of topic (NR1 = 20), not relevant in terms of methodology/design (NR2 = 18), did not discuss deep learning/AI (CA1 = 15), and were opinion-based/non-empirical (CA2 = 12). Finally, 5 articles met the inclusion criteria and were analyzed qualitatively.

2.5 Data analysis

The data obtained was analyzed using descriptive techniques with a content analysis approach to identify the main themes that emerged from the literature. The results of the analysis were then organized and interpreted so that they could contribute both theoretically and practically to the development of Islamic education in the digital age. The series of article selection processes, from the identification stage to the final inclusion, are visualized through the PRISMA Flow chart in Figure 1 below, which systematically shows the number of articles included and excluded at each stage.

3. Results and Discussion

3.1 Analyzed article

Based on the literature review conducted, various previous studies also indicate the significant contribution of deep learning technology to the development of Islamic-based learning systems, in terms of pedagogical, managerial, and value-based aspects. A summary of these research findings can be seen in the following table 1.

Table 1. List of literature review

Article Title	Author	Year	Research Findings
Penerapan Teknologi AI dalam Meningkatkan Efektivitas Pembelajaran PAI	Sri Sugiyarti & Muhammad Isa Anshori	2024	AI enhances learning effectiveness through material personalization and quick response.
Transformasi Digital dalam Pendidikan Islam di Era Disrupsi Teknologi	Fandir	2023	Digital transformation facilitates learning management and accelerates the adoption of Islamic-based technology.
Pengembangan Kurikulum Pendidikan Islam Berbasis Teknologi	Romandoni, A. et al.	2023	There is a need to integrate Islamic values and technology in the curriculum to remain relevant in the digital era.
Digital Transformation in Higher Education Institutions	Mamdouh Alenezi	2023	Digital transformation broadens access and improves the overall efficiency of education.
Pembelajaran Islam di Era Digital: Tantangan dan Peluang	Hasibuan, M.	2022	Technology offers opportunities to convey Islamic values in a contextual and widespread manner.

Based on a literature review of the five scientific articles above, three main themes can be identified. These themes include the integration of technology in educational management, the application of deep learning in Islamic education, and adaptive leadership in digital Islamic education. Each theme illustrates the importance of innovation and technological adaptation to ensure that Islamic education remains relevant and effective in this digital era.

The selection of three main themes in this study is based on the most consistent trends that emerged in the five articles analyzed. First, almost all of the literature emphasizes the importance of integrating technology into Islamic education management, because efficient, data-driven management is the foundation for successful digital transformation. Without good governance, technological innovation will only be partial and difficult to implement comprehensively.

Second, the theme of applying deep learning in Islamic education emerged because this technology is most directly associated with pedagogical aspects in the articles reviewed. Both international and national literature shows that deep learning plays an important role in personalizing material, analyzing learning behavior, and contextual learning. Therefore, this theme emphasizes the relevance of deep learning to the main objectives of Islamic education, namely balancing intellectual and spiritual aspects.

Third, the theme of adaptive leadership in digital Islamic education was chosen because technological transformation does not only concern devices or algorithms, but also human and institutional readiness. The reviewed articles highlight that visionary, innovative, and adaptive leadership are prerequisites for effective technology integration. Without strong leadership, obstacles such as infrastructure limitations and teacher resistance are difficult to overcome. Thus, these three themes are considered representative because they represent the managerial, pedagogical, and leadership dimensions that are three important pillars in the transformation of deep learning-based Islamic education.

3.2 Integration of Technology in Islamic Educational Management

The literature shows that the application of digital technology in Islamic education management can improve efficiency, transparency, and collaboration. Fandir's 2023 study confirms that the digitization of administration facilitates the management of data, curriculum, and human resources (Fandir, 2024). In a global context, Mamdouh Alenezi's 2023 research also found that digital transformation in higher education expands access, improves efficiency, and strengthens the relevance of institutions to industry needs (Alenezi, 2023).

Thus, at the managerial level, deep learning functions not only as a technical tool, but also as a data-driven decision-making strategy. For example, deep learning algorithms can analyze attendance patterns, academic achievements, and student needs, enabling school leaders to formulate evidence-based policies. This is in line with the principles of Islamic education, which emphasize professional and fair stewardship.

3.3 Application of Deep Learning in Islamic Learning

The next theme emphasizes the role of deep learning in strengthening pedagogical aspects. Research by S Sugiyarti and Anshori in 2024 shows that this technology can personalize material according to students' learning styles, making learning more effective (Sugiyarti & Anshory, 2024). D Deep learning through AI-based applications can improve students' understanding of Islamic Education both academically and practically (Santoso, 2025). In a global context, research by Naseer et al. in 2024 in the Heliyon journal confirms that deep learning is capable of creating personalized learning paths in higher education. This is relevant to the needs of Islamic education to accommodate the diversity of students' levels of understanding, whether in fiqh, tafsir, or aqidah, so that each student can develop according to their capacity (Naseer et al., 2024).

In addition, deep learning enables the analysis of religious texts through Natural Language Processing (NLP), provides automatic feedback, and directs students to relevant learning resources. The use of interactive multimedia, as described in Munawir et al.'s 2024 study, also enriches the learning experience without compromising Islamic values. Thus, deep learning is not merely a technological tool, but a means of bridging Islamic scholarly traditions with modern digital approaches (Munawir et al., 2024).

3.4 Adaptive Leadership in Digital Islamic Education

Digital transformation also requires adaptive and visionary leadership. Research conducted by Romandoni et al. in 2024 confirms that adaptive leadership is necessary to ensure effective technology integration at all levels of Islamic education. Leaders need to build digital literacy, encourage innovation, and ensure that Islamic values are maintained in the digitization process (Romandoni et al., 2024). From a global perspective, the literature emphasizes the importance of change leadership that is not only technology-oriented but also human-readiness-oriented (Nufuz et al., 2025). This means that Islamic education leaders need to prepare teachers, students, and parents to accept change. Obstacles such as infrastructure limitations and teacher resistance can be overcome with continuous training strategies, multi-party collaboration, and internal policies that support innovation. With adaptive leadership, deep learning-based digital transformation can be directed to strengthen spirituality, ethics, and the vision of Islamic civilization, rather than merely pursuing modernity.

The three themes above show that deep learning has dual potential: as a technical instrument to improve efficiency, and as an educational strategy that maintains the relevance of Islam amid global challenges. The integration of digital management, data-driven learning, and adaptive leadership forms a complementary conceptual framework. By comparing findings from national and international literature, it is clear that the main challenges are the digital literacy gap among teachers

and infrastructure limitations. However, there are significant opportunities to develop adaptive, contextual, and personalized Islamic learning models. These three main themes can be mapped into a conceptual framework that illustrates the interconnection between Islamic values, digital education management, the application of deep learning, and adaptive leadership, as shown in Figure 2.

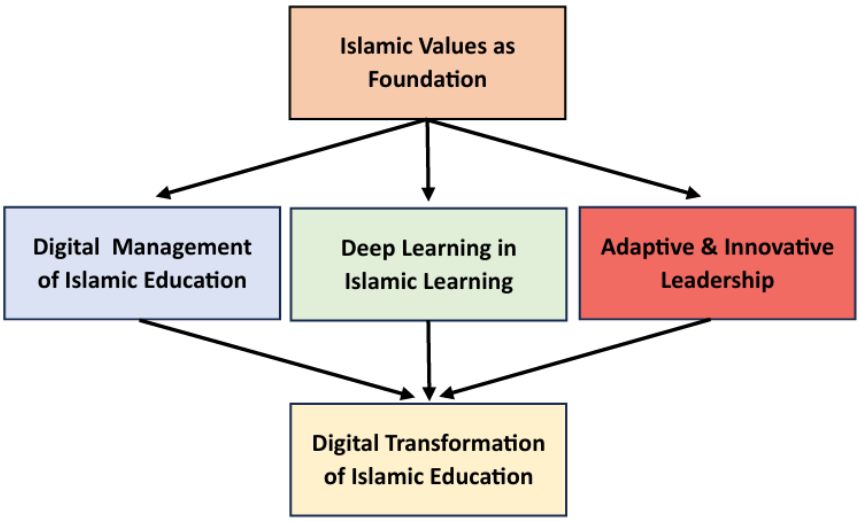

Fig. 2. Conceptual framework

Figure 2 presents a visual representation of the relationship between the three main themes, showing that Islamic values form the basis for three main pillars: (1) digital management of Islamic education, which emphasizes efficiency and transparency; (2) deep learning in Islamic learning, which plays a role in personalizing and contextualizing learning materials; and (3) adaptive and innovative leadership, which serves to guide and ensure that technology integration remains in line with the vision of Islamic education. These three pillars then converge on the digital transformation of Islamic education, which is a strategic change process that maintains the relevance of Islamic education in the postmodern era without losing its identity.

4. Conclusion

Based on the results of the literature review, this study concludes that the integration of deep learning in Islamic education has three main contributions, namely strengthening the personalization of the learning process, improving the efficiency and transparency of education management, and supporting adaptive leadership that is relevant to the demands of the digital era. However, this study has limitations because it only analyzed five articles obtained through one database, namely Google Scholar. Therefore, further research is recommended to expand the data sources, increase the number of articles reviewed, and test the proposed conceptual framework through an empirical approach. With these steps, the understanding of deep learning-based digital transformation in Islamic education will become more comprehensive and applicable. Strategically, the application of deep learning is not only seen as a technological innovation, but also as an important effort to ensure the sustainability and relevance of Islamic values amid the dynamics of postmodern change.

Acknowledgment

The authors would like to thank all institutions and individuals who contributed to the completion of this study, especially those who provided technical assistance in data collection and visualization. The authors also extend my special thanks to the Islamic University of Cirebon for providing moral and material support to publish this article.

Declarations

Author contribution : The first author contributed to data collection, analyzing, interpreting the data of the research, and drafted the article. The second author contributed as the supervisor who guided the research process.
Funding statement : This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.
Conflict of interest : The author declares no conflict of interest.
Additional information : No additional information is available for this paper.

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