



Neuroscience and Fitrah Integration: Brain Mechanisms Shaping Contemporary Islamic Education and Holistic Learning

Metriadi¹, Erizal¹, Zidni Ilman Nafi'an², Ahmad Lahmi², Julhadi²

¹STAI MA Bayang Pesisir Selatan Sumatera Barat Indonesia

²Universitas Muhammadiyah Sumatera Barat, Indonesia

✉ metriadi79@gmail.com*

Abstract

This study aims to analyze the mechanisms of the brain and nervous system in the learning process and to examine their relevance to the concept of fitrah in contemporary Islamic education. This study is motivated by emerging findings in neuroscience that explain the biological processes of learning, while Islamic education relies on the concept of fitrah as the foundation for the holistic development of human potential. However, studies that integrate these two perspectives remain relatively limited. The study employed a Systematic Literature Review (SLR) method in accordance with the PRISMA 2020 guidelines. Data were obtained by searching for scientific articles in the Google Scholar, Scopus, Dimensions, DOAJ, and Crossref databases published between 2020 and 2026. Literature meeting the inclusion criteria was analyzed using thematic synthesis techniques to identify patterns, concepts, and relationships among variables. The results indicate that attention, emotion, memory, executive function, and neuroplasticity are the primary brain mechanisms influencing learning success. This study found a conceptual common ground between neuroscience and Islamic education that paves the way for a more holistic learning paradigm. This model is expected to serve as a conceptual foundation for the development of evidence-based Islamic education including curriculum, learning strategies, and character education in the contemporary educational landscape.

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INTRODUCTION

Advances in science and technology in the 21st century have brought about significant changes to the global educational paradigm. One discipline that has experienced rapid development and made an important contribution to the world of education is neuroscience. Neuroscience is the field of study that examines the structure, function, development, genetics, biochemistry, physiology, and disorders related to the human nervous system and brain. In the

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context of education, neuroscience provides a scientific understanding of how the brain receives, processes, stores, and retrieves information, thereby helping educators design learning processes that are more effective and aligned with students' biological characteristics (Page et al., 2021). Advances in educational neuroscience have even given rise to a new approach known as brain-based learning a learning model based on the brain's natural processes during learning (Goldberg et al., 2021).

Findings in modern neuroscience show that the learning process is not merely a mechanical cognitive activity, but rather involves complex interactions between various parts of the brain and the nervous system. The frontal lobe plays a role in decision-making, planning, and executive functions; the limbic system is involved in regulating emotions and motivation; while the hippocampus plays a crucial role in the formation of long-term memory (Fandakova & Hartley, 2020). Furthermore, the concept of neuroplasticity explains that the brain has the ability to form and strengthen new synaptic connections in response to experiences and ongoing learning processes (Merriam & Tisssdell, 2015). These findings provide a scientific basis for the idea that every individual has the potential to develop through appropriate, structured, and meaningful learning experiences.

In the world of contemporary education, understanding how the brain and nervous system work has become increasingly important as learners face a variety of new challenges. The digital age has brought a flood of information, accelerated social change, and increased distractions that affect learners' ability to concentrate, regulate their emotions, and learn. Various studies indicate that learning strategies that take into account students' attention, emotions, motivation, and active engagement tend to yield more optimal learning outcomes compared to teacher-centered learning methods (Miller & Brewer, 2015). Therefore, integrating neuroscience findings into educational practice has become an increasingly urgent need to improve the quality of learning and foster the holistic development of students' potential.

On the other hand, Islamic education has, from the very beginning, been based on a paradigm that views human beings as creatures possessing innate potential (*fitrah*) that must be developed through the educational process. The concept of *fitrah* is one of the fundamental concepts in Islamic anthropology, referring to the original state of human beings as created by Allah SWT with various potentials for goodness, a natural inclination toward *tawhid*, the ability to think, and the capacity to develop into a perfect individual (*insan kāmīl*). This concept is based on the words of Allah SWT in Surah Ar-Rūm [30]: 30, which affirms that human beings are created in accordance with Allah's *fitrah*, which remains unchanged. A hadith of the Prophet Muhammad (peace be upon him) also explains that every child is born in a state of *fitrah*, and it is the environment and education that play a role in shaping their development (Al-Bukhari, 2002; Muslim, 2007).

The concept of *fitrah* has far-reaching implications in Islamic education because it views students as individuals with multidimensional potential that must be developed in a balanced manner. Education aims not only to develop intellectual abilities but also to nurture spiritual, emotional, moral, social, and physical aspects in an integrated manner. Islamic educational thinkers such as Al-Ghazali, Ibn Khaldun, and Syed Muhammad Naquib al-Attas emphasize that the primary goal of education is to develop the full potential of human beings so that they may optimally fulfill their role as vicegerents and serve Allah SWT. Therefore, Islamic education is, in essence, a process of actualizing human *fitrah* toward self-perfection, grounded in divine and humanistic

values.

Nevertheless, the development of contemporary Islamic education still faces various challenges related to teaching approaches. Educational practices in many Islamic educational institutions still tend to focus on knowledge transfer, academic achievement, and mastery of subject matter, while the holistic development of students' potential has not yet become a primary concern. On the other hand, various neuroscience-based learning innovations emerging in modern education have not yet been systematically integrated into the framework of Islamic education. As a result, there is a gap between the development of modern science and Islamic educational concepts, which actually share the same orientation: the optimal and comprehensive development of human potential.

A number of recent studies have examined the application of neuroscience in education and have shown that an understanding of how the brain works can enhance students' learning effectiveness, critical thinking skills, creativity, and emotional regulation (Grant & Booth, 2009). Other studies also affirm that the concept of fitrah can serve as a philosophical foundation for building an Islamic education system oriented toward the development of all dimensions of humanity. However, research linking these two perspectives remains relatively limited. Most neuroscience research focuses on the biological and cognitive aspects of learning, whereas research on Islamic education tends to discuss fitrah primarily from normative, philosophical, and theological perspectives. There has been little research that specifically integrates the mechanisms of the brain and nervous system with the concept of fitrah as a learning paradigm in contemporary Islamic education.

Research in educational neuroscience has thus far focused primarily on the biological, cognitive, and psychological aspects of learning through the approaches of educational neuroscience and brain-based learning. In contrast, research in Islamic education tends to discuss the concept of fitrah from normative, philosophical, and theological perspectives. The connection between the neurobiological mechanisms of learning and the development of human fitrah as the goal of Islamic education has not yet been comprehensively explored. Thus, there is an academic need to develop a conceptual framework capable of integrating modern neuroscience findings with the fitrah paradigm as the foundation of contemporary Islamic education.

Based on the above discussion, this article aims to analyze the mechanisms of the brain and nervous system in the learning process, examine the concept of fitrah from the perspective of Islamic education, and formulate an integrative model between neuroscience and fitrah-based learning. The integration of these two perspectives is expected to produce a learning paradigm that is not only cognitively and scientifically effective but also capable of developing students' spiritual, moral, emotional, and social dimensions in a balanced manner.

Recent research indicates that the field of educational neuroscience has advanced rapidly through studies on neuroplasticity, executive function, memory, emotional regulation, and brain-based learning as the foundation for developing effective learning strategies. At the same time, Islamic education studies have begun to develop a fitrah-based learning paradigm that views students as individuals possessing an innate potential for holistic development (Miller & Brewer, 2015). However, these two fields are still developing separately and have not yet produced a conceptual model that systematically links brain mechanisms with the development of fitrah in Islamic education.

The novelty of this research lies in the development of the conceptual framework of the Neuro-Fitrah Learning Model a learning model that integrates the functioning of the brain and nervous system, including neuroplasticity, attention, memory, emotions, and executive functions, with the development of students' innate potential in Islamic education. This model offers a new perspective that combines the scientific foundations of modern neuroscience with the Islamic anthropological paradigm, resulting in a holistic, evidence-based learning approach oriented toward the formation of the "*insan kāmīl*" as the primary goal of contemporary Islamic education.

Various previous studies have examined the relationship between neuroscience and education. [Halstead, \(2007\)](#) asserts that an understanding of brain development can help educators design learning experiences that optimally support student development. [Hanief et al., \(2023\)](#) explain that educational neuroscience provides a scientific foundation for the neural dynamics underlying the learning and teaching processes. Meanwhile, [Nowell et al., \(2017\)](#) found that the implementation of brain-based learning can improve student learning outcomes and engagement.

In the field of Islamic education, [Fandakova & Hartley, \(2020\)](#) examined the concept of fitrah-based education as an effort to holistically develop human innate potential. [Nadhiroh & Anshori, \(2023\)](#) examined the integration of the concept of *fitrah* with the Merdeka Belajar paradigm in Islamic education. [Tullah & Hidayatullah, \(2023\)](#) explain that fitrah is the foundation for the holistic development of the human person, encompassing intellectual, spiritual, moral, and social aspects.

Although these studies have made significant contributions, there is a fundamental difference between them and the research conducted in this article. Previous studies generally discussed neuroscience and Islamic education separately or linked them only in specific aspects. This study, however, seeks to develop a conceptual model that specifically integrates the mechanisms of the brain and nervous system with the concept of fitrah in contemporary Islamic education through the Neuro-Fitrah Learning Model approach. Thus, this article not only explains the relationship between neuroscience and Islamic education but also offers a new theoretical framework that can serve as the foundation for developing a holistic, evidence-based approach to Islamic learning that is relevant to the educational challenges of the 21st century.

Based on the results of the literature review, there are three main gaps that still require further research. The first is a theoretical gap: educational neuroscience has advanced rapidly in explaining learning processes based on the biological mechanisms of the brain and nervous system. In contrast, Islamic education primarily examines the concept of fitrah human's innate potential from normative and philosophical perspectives. To date, there is no theoretical model that comprehensively integrates these two perspectives. Second is the conceptual gap: most neuroscience research focuses on aspects such as neuroplasticity, memory, attention, emotional regulation, and executive functions. Meanwhile, research on fitrah focuses on the potential for monotheism, character building, and spiritual development; the relationship between neurological mechanisms and the actualization of fitrah has not yet been extensively explained conceptually. Third is the practical gap: modern Islamic educational institutions still face challenges in implementing learning strategies that align with how the brain works, are grounded in Islamic values, and support the holistic development of students. There is currently no learning model available that operationally integrates the principles of

neuroscience and fitrah-based education.

The novelty of this study lies in the development of a conceptual model the neuro-fitrah learning model that integrates perspectives from neuroscience, namely neuroplasticity, memory, attention, emotion, and executive function, with perspectives from Islamic education, namely the fitrah of faith, the fitrah of intellect, the fitrah of emotion, the fitrah of social interaction, and the fitrah of morality.

This model offers a new paradigm explaining that the actualization of human fitrah in Islamic education can be understood through the biological mechanisms of the brain and nervous system at work during the learning process. Thus, this study makes a scientific contribution in the form of a Theoretical Contribution: integrating neuroscience and Islamic education into a single conceptual framework. A Methodological Contribution, offering an interdisciplinary approach between neuroscience and Islamic education. A Practical Contribution, serving as the foundation for the development of neuro-fitrah-based curricula and learning strategies in Islamic educational institutions.

Based on a theoretical review, previous research, and the identification of research gaps, it can be concluded that the integration of the brain's mechanisms and the nervous system with the concept of fitrah in Islamic education still requires more comprehensive conceptual development. Therefore, this study proposes the Neuro-Fitrah Learning Model as an integrative framework to explain the learning process in contemporary Islamic education in a holistic, scientific, and Islamic-values-based manner.

METHODS

This study employed a Systematic Literature Review (SLR) method in accordance with the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The SLR method was chosen because it allows researchers to systematically identify, evaluate, and synthesize various relevant research findings, thereby yielding a comprehensive understanding of a topic of study (Anidar et al., 2026; Aryasutha et al., 2025; Efendi et al., 2026; Engkizar et al., 2024; 2025; 2026; Lestari et al., 2021; Page et al., 2021). In the context of this study, the SLR was used to analyze and synthesize the literature on the mechanisms of the brain and nervous system in learning, the concept of fitrah in Islamic education, and the opportunities for integrating the two in the development of a contemporary Islamic learning model.

The SLR approach is considered appropriate because this study does not focus on collecting field data, but rather on a critical analysis of various research findings that have been published in reputable national and international scientific journals. Through this approach, the researcher can identify theoretical developments, identify research gaps, and construct a new conceptual framework, which constitutes the main contribution of this study.

This study employs an interdisciplinary approach, integrating perspectives from educational neuroscience and Islamic education. The neuroscience approach is used to understand the biological mechanisms of learning, which involve brain structure, the nervous system, neuroplasticity, memory, attention, emotions, and executive functions. Meanwhile, the Islamic education approach is used to analyze the concept of fitrah as the foundation for the development of human potential, which encompasses spiritual, intellectual, emotional, social, and moral dimensions.

Through this interdisciplinary approach, this study seeks to construct a

conceptual synthesis capable of explaining the relationship between the neurological mechanisms of learning and the actualization of fitrah in contemporary Islamic education.

The research data were sourced from scientific literature obtained through various reputable academic databases. Data sources were divided into two categories: primary and secondary sources. Primary sources consist of scientific articles published in national and international journals indexed in Scopus, Web of Science (WOS), DOAJ, Google Scholar, and the ERIC database. The articles used were published between 2020 and 2026 to align with journal policies that prioritize up-to-date references. Meanwhile, secondary sources include books on educational neuroscience, books on Islamic education, classical Islamic texts, the Quran and hadith, educational policy documents, and relevant scientific conference proceedings.

The literature search strategy was conducted systematically using a combination of keywords tailored to the research focus. Keywords were used in both English and Indonesian to broaden the scope of the search.

Inclusion and Exclusion Criteria

To ensure the quality and relevance of the data, this study applied the following inclusion and exclusion criteria.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Year	2020–2026	Before 2020 (except primary Islamic sources)
Document Type	Journal articles, academic books, classical texts, conference proceedings	Blogs, non-scholarly websites, opinion pieces
Language	Indonesian and English	Languages other than Indonesian and English
Topic	Educational neuroscience, fitrah, Islamic education	Not relevant to research focus
Indexing	Scopus, WoS, DOAJ, Google Scholar	Not indexed or unverified
Article Quality	Peer-reviewed	Non peer-reviewed

Literature Selection Process Based on PRISMA 2020

The article selection process follows the PRISMA 2020 workflow, which consists of four main stages: first, identification. Researchers identify articles from various databases using predetermined keywords. Second, screening: articles with titles and abstracts that are not relevant to the research focus are eliminated. Third, eligibility: Articles that pass the screening stage are reviewed in full (full-text review) to ensure they align with the research objectives. Fourth, inclusion: Articles that meet all inclusion criteria are included in the synthesis and analysis process.

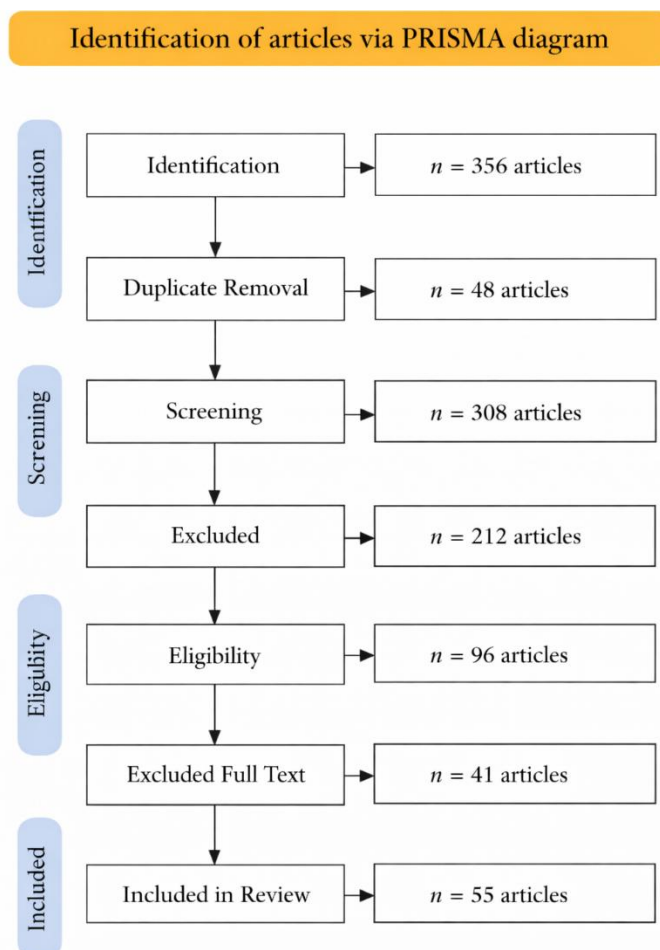


Fig 1. The document screening process for data from Scopus and Google Scholar on the topic of the brain's and nervous system's mechanisms of action in the learning process, using the PRISMA software

The data were analyzed using thematic content analysis combined with narrative synthesis. The analysis was conducted in the following stages: Stage 1: Data Reduction. The researcher grouped the articles based on the following main themes: Mechanisms of brain function, The nervous system in learning, Neuroplasticity, Brain-Based Learning, Fitrah in Islamic education, and the integration of neuroscience and Islamic education. Stage 2: Data Coding. Each article was coded based on: author, year of publication, research objectives, research methods, and main findings. Stage 3: Thematic Synthesis. The coded data was then synthesized into major themes that reveal patterns of relationships between neuroscience and Islamic education. Stage 4: Conceptual Integration. The final stage involved developing the Neuro-Fitrah Learning Model as a conceptual framework resulting from the integration of findings derived from the literature.

To ensure the validity of the research, the following strategies were implemented: Source Triangulation. Comparing various research findings from international and national journals. Audit Trail. Documenting the entire process of searching for, selecting, and analyzing articles. Peer Debriefing. Comparing the results of the synthesis with key theories in neuroscience and Islamic education. Reputable References. Prioritizing articles indexed in Scopus, Web of Science, DOAJ, and Google Scholar.

RESULT AND DISCUSSION

Results of the Literature Synthesis

Based on a Systematic Literature Review (SLR) conducted in accordance with the PRISMA 2020 guidelines, 55 articles were identified that met the inclusion criteria and were relevant to the research focus. These articles spanned various disciplines, particularly educational neuroscience, educational psychology, brain-based learning, Islamic education, fitrah-based education, and interdisciplinary studies linking science and religion.

The synthesis results indicate that three main themes dominate the literature: i) the mechanisms of the brain and nervous system in learning; ii) the concept of fitrah as the foundation of Islamic education; and iii) opportunities for integrating neuroscience and Islamic education in the development of contemporary learning models.

Table 2. Main Themes of the Literature Synthesis Results

Theme	Focus of Study	Number of Articles
Neuroscience and Learning	Neuroplasticity, memory, attention, emotion, executive function	24
Fitrah-Based Islamic Education	Concept of fitrah, potential development, <i>insan kamil</i>	17
Integration of Neuroscience and Islamic Education	Neurospirituality, character education, holistic learning	14
Total	-	55

The data indicate that neuroscience of education research still dominates scientific publications compared to integrative research between neuroscience and Islamic education. This situation also underscores that there is still academic room for the development of learning models based on the integration of these two disciplines.

How the Brain and Nervous System Function in Learning

A review of the literature indicates that the learning process involves the simultaneous activity of various parts of the brain through a complex network of the nervous system. Information received by the sensory organs is processed by the central nervous system before being translated into perception, understanding, and behavioral responses. In the context of learning, the cerebral cortex functions as the center for information processing, while the hippocampus plays a role in the formation of long-term memory and the limbic system contributes to the regulation of emotions and learning motivation (Fandakova & Hartley, 2020; Immordino-Yang, 2020).

Neuroscience research shows that attention is the primary gateway that determines the successful transfer of information from short-term memory to long-term memory. Information that does not receive sufficient attention tends not to be processed in depth and is therefore easily forgotten (Howard-Jones, 2022). Therefore, learning strategies that can improve students' focus will have a positive impact on learning outcomes.

In addition to attention, emotions also play a crucial role in the learning process. Activity in the amygdala which is connected to the limbic system determines the emotional significance of a learning experience. The stronger the engagement of positive emotions in the learning process, the greater the likelihood that the information will be stored in long-term memory (Immordino-Yang, 2020). These findings reinforce the argument that learning that is enjoyable, meaningful, and contextual is more effective than learning that is mechanical and monotonous.

Neuroplasticity and the Development of Human Potential

One of the most significant findings in modern neuroscience is the concept of neuroplasticity the brain's ability to form, strengthen, and modify synaptic connections in response to experience and learning activities (Elizabeth, 2016). This finding challenges the old paradigm that viewed intelligence as a fixed ability. Instead, research shows that the brain's structure and function can develop throughout life through practice, experience, and a supportive learning environment.

The principle of neuroplasticity suggests that the more frequently a neural pathway is used, the stronger the connections that form. Conversely, connections that are rarely used will weaken through a process called synaptic pruning (Susanna et al., 2023). From an educational perspective, this explains why repetition, habituation, and hands-on practice are crucial factors in enhancing students' cognitive abilities.

These findings are strongly relevant to the concept of fitrah in Islamic education. Islam holds that every human being is born with various potentials that can be developed through education and the right environment. Thus, neuroplasticity can be understood as a biological mechanism that enables the actualization of human fitrah through a continuous learning process (Tokuhama-Espinosa, 2018).

The Concept of Fitrah in Islamic Education

The findings of this synthesis indicate that the concept of fitrah serves as the anthropological foundation of Islamic education. Fitrah is understood as the innate potential bestowed by Allah SWT upon every human being at birth, encompassing spiritual, intellectual, emotional, social, and moral dimensions (Fandakova & Hartley, 2020). This concept is rooted in Quranic verse Ar-Rūm [30]: 30 and the hadith of the Prophet Muhammad (peace be upon him), which explain that every child is born in a state of fitrah and that the environment plays a role in shaping their development (Al-Bukhari, n.d.; Muslim, n.d.).

In classical Islamic educational thought, Al-Ghazali explains that education aims to develop the full potential of human beings toward moral perfection and closeness to Allah. Meanwhile, Ibn Khaldun emphasized the importance of the social environment and education in shaping human intellectual abilities. This view is reinforced by Syed Muhammad Naquib al-Attas, who asserts that the goal of education is to produce civilized human beings (*insan adabi*) through the balanced development of all dimensions of human nature (*fitrah*) (Al-Attas, 1980).

Contemporary studies indicate that fitrah-based education is oriented toward the holistic development of all aspects of humanity; thus, it focuses not only on academic achievement but also on the development of students' character, spirituality, and social responsibility (Nowell et al., 2017).

The Integration of Neuroscience and Fitrah-Based Learning

The results of the analysis indicate a strong convergence between neuroscience findings and the concept of fitrah in Islamic education. Neuroplasticity explains the brain's ability to develop through learning experiences, while the concept of fitrah explains that humans possess innate potential that can be realized through education (Nadhiroh & Anshori, 2023). Both concepts affirm that human development is a dynamic process that can be optimized through a supportive environment.

Similarly, neuroscience research on emotional regulation indicates that the limbic system plays a crucial role in the learning process and the formation of behavior (Immordino-Yang, 2020). These findings align with Islamic education, which places moral cultivation, self-control (*mujābah al-nafs*), and the

purification of the soul (*taẓkiyat al-nafs*) as essential components of the educational process (An-Nahlawi, 2021).

Research by Grant & Booth, (2009) confirms that learning approaches that take into account how the brain works tend to yield better learning outcomes. Meanwhile, studies by Susanna et al., (2023) show that fitrah-based education can develop students' spiritual, intellectual, and moral dimensions in a balanced way. Therefore, integrating these two perspectives has the potential to produce a learning model that is not only cognitively effective but also spiritually and character-buildingly meaningful.

Development of the Neuro-Fitrah Learning Model

Based on a synthesis of various previous studies, this research proposes the Neuro-Fitrah Learning Model as an integrative conceptual framework that links the biological mechanisms of learning with the development of human fitrah. This model is built upon five main components of neuroscience, namely: attention; emotion; memory; executive function; and neuroplasticity.

These five components are then integrated with the five dimensions of fitrah, which include spiritual, intellectual, emotional, social, and moral fitrah (Butros & Taylor, 2023). Thus, the learning process aims not only to produce academic competencies but also to shape Islamic character, foster spiritual awareness, develop emotional regulation skills, and strengthen students' sense of social responsibility. These findings support the idea that contemporary Islamic education needs to develop an evidence-based learning paradigm that is simultaneously oriented toward the holistic development of human fitrah (Sahin, 2018).

CONCLUSION

Overall, this study shows that the integration of neuroscience and fitrah-based learning is a promising approach in the development of contemporary Islamic education. Through an understanding of the mechanisms of the brain and nervous system, combined with the fitrah paradigm, Islamic education can move toward a learning model that is more scientific, humanistic, spiritual, and relevant to the needs of students in the era of digital transformation and a knowledge-based society. Thus, the Neuro-Fitrah Learning Model proposed in this study is expected to serve as a conceptual contribution to the future development of Islamic educational theory and practice. Consequently, this study reaffirms that neuroscience and Islamic education are not two conflicting disciplines but can complement one another in building a more holistic, humanistic, and evidence-based paradigm for contemporary Islamic education.

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