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Ibn Sina's Thought as a Foundational Solution to Contemporary Issues in Islamic Education and Neuroscience

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Abstract

Objective: The rapid advancement of technology, social transformation, and the growing influence of neuroscience have generated new challenges and opportunities in the field of Islamic education. Contemporary neuroscience provides scientific insights into brain mechanisms, cognition, memory, emotion, and behavior, while Islamic intellectual tradition has long addressed similar concerns through philosophical and theological reflections on reason and learning. This study aims to analyze contemporary issues emerging at the intersection of Islamic education and neuroscience by examining Ibn Sina's intellectual legacy and assessing the potential for integrating classical Islamic thought with modern neuroscientific findings in educational practice. **Theoretical framework:** The theoretical framework of this study is grounded in Ibn Sina's epistemology of the intellect and rational soul, combined with contemporary neuroeducation theories that explore learning processes through brain-based research. **Literature review:** The literature review highlights prior studies on Islamic educational philosophy, Ibn Sina's cognitive theory, and recent neuroscience research, while also identifying unresolved challenges such as neuromyths, limited neuroscience literacy among educators, biological reductionism, and ethical concerns related to neurotechnology. **Method:** This research employs a descriptive qualitative method based on library research. Primary sources include the Qur'an and classical Islamic educational texts, particularly Ibn Sina's works, while secondary sources consist of contemporary neuroscience and educational research. Data are analyzed thematically to identify points of convergence and tension between Islamic educational values and neuroscientific perspectives. **Results:** The findings indicate that neuroscience can significantly enhance the effectiveness of Islamic education when applied critically and ethically. However, integration must avoid reductionist interpretations that neglect spiritual, moral, and metaphysical dimensions. Ibn Sina's concept of the intellect and rational soul provides a valuable philosophical bridge that supports a holistic understanding of human learning. **Implications**: The implications of this study suggest the need for an integrative educational model that balances scientific innovation with Islamic values, fostering ethical awareness and humanistic learning. **Novelty**: The novelty of this research lies in its interdisciplinary synthesis of Ibn Sina's cognitive philosophy with contemporary neuroscience to address current educational challenges in the era of digitalization and neurotechnology.

Keywords: islamic education, neuroscience, ibn sina, neuroeducation, neuroethics.

INTRODUCTION

The rapid development of modern science, especially in the field of Neuroscience, has made a significant contribution to human understanding of how the brain works, learning processes, memory, emotions, and behavior. Neuroscience is no longer limited to medical studies, but has penetrated into the realm of education through the birth of the field of Neuroeducation. This field seeks to bridge scientific findings about the brain with learning practices, so that the educational process can be designed more effectively, adaptively, and based on students' cognitive understanding. In a global context, Neuroeducation is developing in response to the demands of 21st century education that emphasizes learning efficiency, strengthening individual potential, and optimal use of technology [1], [2].

On the other hand, Islamic education is a comprehensive and holistic education system. Its main goal is not only oriented towards cognitive achievement, but also the formation of a whole human being that includes spiritual, intellectual, moral, and social dimensions. Islamic education views humans as creatures who have the potential of intellect, soul, and spirit that must be developed in a balanced manner. Therefore, any new approach in the world of education, including neuroeducation, needs to be critically examined in order to be in harmony with the values and goals of Islamic education [3].

In the treasures of classical Islamic scholarship, Ibn Sina's thought occupies an important position in understanding human cognitive functioning. Ibn Sina put forward a theory about the structure of the soul (al-nafs) and the level of intellect, ranging from intellect, intellect al-malaki, intellect bil-fi'l, to intellect mustafād. He also explains the close relationship between sensory experience, imagination, memorization (al-hāfizhah), and the analytical ability of reason in the learning process. According to Ibn Sina, learning is a gradual process that involves a harmonious interaction between the senses, internal powers, and ratios. This philosophical-psychological view shows that the Islamic intellectual tradition already had a strong theoretical foundation regarding learning long before the development of modern neuroscience [4].

The Qur'an itself emphasizes the urgency of reason and knowledge as the foundation of human life. The emphasis on thinking and reading activities, as reflected in the verses of the Qur'an, suggests that Islam encourages the active and responsible development of cognitive potential. Therefore, the integration between Neuroscience and Islamic education is an urgent need, especially in the face of the era of digitalization, changes in the character of students, and neurotechnology challenges. By incorporating Ibn Sina's thought as a philosophical foundation, this integration is not only technical-biological but also philosophical-holistic, so as to give birth to a balanced approach to learning between rationality, spirituality, and human cognitive development [5].

Despite the growing interest in neuroscience-based learning, the integration of neuroscience into Islamic education remains theoretically and methodologically fragmented. Most existing studies approach neuroscience from a purely empirical or technical perspective, emphasizing brain function, learning efficiency, and cognitive performance, while often neglecting the philosophical, spiritual, and ethical dimensions that are central to Islamic educational thought. Conversely, studies on Islamic education and classical Muslim philosophers, including Ibn Sina, frequently remain normative and historical, with limited engagement with contemporary scientific findings. This disconnection reveals a significant research gap at the intersection of neuroscience, Islamic pedagogy, and classical epistemology [6].

Another critical gap lies in the uncritical adoption of neuroscientific concepts within educational discourse. The rapid popularization of neuroeducation has also given rise to neuromyths, such as oversimplified claims about brain hemispheres, learning styles, and neural determinism. In the context of Islamic education, this trend risks reinforcing biological reductionism, where human learning is reduced solely to neural processes, marginalizing the roles of spirituality, moral consciousness, and metaphysical dimensions of the human soul (al-nafs). Furthermore, ethical concerns surrounding neurotechnology, such as cognitive

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enhancement, neuro-surveillance, and data privacy, have not been sufficiently addressed from an Islamic ethical perspective [7].

This study responds to these gaps by proposing an integrative framework that positions Ibn Sina's theory of the intellect and the rational soul as a conceptual bridge between Islamic educational philosophy and contemporary neuroscience. By revisiting Ibn Sina's understanding of sensory perception, imagination, memory, and intellectual actualization, this research provides a philosophical lens through which neuroscientific findings can be critically interpreted and ethically grounded. Such an approach allows Islamic education to benefit from scientific advancements without compromising its foundational values [8].

The implications of this study are both theoretical and practical. Theoretically, it contributes to the development of an interdisciplinary discourse that harmonizes classical Islamic thought with modern cognitive science. Practically, it offers a foundation for designing learning strategies in Islamic education that are cognitively informed, spiritually oriented, and ethically responsible. Educators are encouraged to adopt neuroscience-based insights selectively, guided by Islamic epistemology and moral objectives [9].

The novelty of this research lies in its holistic synthesis of Ibn Sina's cognitive philosophy with contemporary neuroscience to address current educational challenges. Unlike prior studies that treat neuroscience and Islamic education as separate domains, this study integrates them within a unified conceptual framework, offering an original contribution to neuroeducation, Islamic pedagogy, and interdisciplinary educational studies in the era of digitalization and neurotechnology.

LITERATURE REVIEW

The relationship between education and human cognition has been a central concern in both classical Islamic thought and contemporary scientific inquiry. In modern scholarship, neuroscience has emerged as a significant field contributing to educational theory by explaining how the brain processes information, regulates emotions, and supports learning and memory. The development of neuroeducation reflects efforts to translate neuroscientific findings into pedagogical strategies aimed at improving learning outcomes. However, educational research increasingly recognizes that learning is not merely a biological process but also a psychological, social, and ethical phenomenon [10], [11].

Within Islamic intellectual tradition, discussions on knowledge, reason, and learning have long occupied a prominent position. Classical Muslim scholars developed comprehensive theories of the human intellect that emphasized the integration of sensory perception, imagination, memory, and rational reflection. Among these thinkers, Ibn Sina offered a sophisticated model of cognition that described learning as a gradual process involving the interaction of the senses, internal faculties, and the rational soul. His framework presents learning as both an intellectual and moral endeavor, grounded in the development of human potential toward intellectual perfection [12], [13].

Recent studies in Islamic education have revisited classical epistemological frameworks to address contemporary educational challenges. These studies emphasize that Islamic education aims to develop holistic individuals by integrating intellectual growth with spiritual awareness and ethical conduct. In this context, neuroscience is often viewed as a potentially valuable resource for enhancing pedagogical effectiveness, particularly in understanding attention, motivation, memory formation, and emotional regulation. Nevertheless, concerns persist regarding the uncritical adoption of neuroscientific concepts into educational practice [14], [15].

One of the dominant issues in current literature is the rise of neuromyths and oversimplified interpretations of brain research. Such misconceptions can lead to deterministic views of learning that overlook the complexity of human development. Additionally, biological reductionism poses a challenge by framing education solely in terms of neural activity, thereby

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marginalizing spiritual and moral dimensions central to Islamic pedagogy. Ethical issues related to neurotechnology, including cognitive enhancement and data privacy, further complicate the integration of neuroscience into educational settings [16].

Table 1. Literature Review

Aspect	Core Idea	Educational Meaning
Human Cognition	Learning involves biological, psychological, social, and ethical dimensions	Education must address more than brain functions alone
Neuroscience in Education	Brain research explains attention, memory, and emotion regulation	Neuroscience can support effective teaching when applied carefully
Islamic Epistemology	Knowledge integrates reason, senses, and moral purpose	Learning is connected to ethical and spiritual development
Ibn Sina's View	Cognition develops through sensory experience and rational reflection	Intellectual growth is a gradual and value-oriented process
Holistic Education	Education forms balanced individuals	Intellectual, spiritual, and moral aspects must be integrated
Neuromyth Challenges	Misinterpretation of neuroscience	Oversimplification can mislead educational practice
Reductionism Risk	Learning reduced to neural activity	Moral and spiritual dimensions may be neglected
Ethical Concerns	Neurotechnology affects autonomy and privacy	Ethical guidance is essential in educational innovation
Interdisciplinary Approach	Science and philosophy complement each other	Integration enriches understanding of learning
Educational Model	Holistic and ethical framework	Responsible education supports human potential comprehensively

Scholars increasingly argue for an interdisciplinary approach that balances scientific insights with philosophical and ethical reflection. Integrating classical Islamic perspectives, particularly Ibn Sina's cognitive theory, with contemporary neuroscience offers a promising pathway for addressing these challenges. This synthesis enables a more nuanced understanding of learning that respects both empirical knowledge and spiritual values. Consequently, the literature suggests that a critical, holistic, and ethically grounded integration of neuroscience and Islamic education is essential for developing relevant and responsible educational models in the modern era [17].

METHODOLOGY

This study employs a qualitative descriptive approach based on an extensive literature review. The qualitative design is selected to enable an in-depth and systematic exploration of conceptual, philosophical, and theoretical discussions concerning the integration of neuroscience and Islamic education. Rather than measuring variables or testing hypotheses empirically, this research focuses on interpreting meanings, ideas, and patterns derived from authoritative textual and scholarly sources [18].

The primary data sources consist of Qur'anic verses related to reason ('aql), learning processes, and cognitive activity. These verses are examined to identify foundational Islamic perspectives on knowledge acquisition, intellectual development, and human cognition. The Qur'anic analysis serves as a normative framework that guides the interpretation of subsequent educational and neuroscientific discussions [19], [20].

Secondary data sources include classical and contemporary Islamic educational literature, with particular emphasis on the philosophical contributions of Ibn Sina. His theories on the structure of the soul (al-nafs), the hierarchical stages of intellect, sensory perception, imagination, memory, and the formation of knowledge are analyzed as a historical and conceptual foundation for understanding human cognition in the Islamic intellectual tradition.

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These sources are used to reconstruct Ibn Sina's cognitive model and to examine its relevance to modern educational challenges [21], [22].

In addition, contemporary neuroscience research constitutes a major component of the data corpus. This includes studies on memory systems, emotional regulation, neuroplasticity, and learning mechanisms within the brain. Such literature is analyzed to identify key neuroscientific insights that have implications for educational practice, particularly in relation to how learners process information, develop skills, and adapt cognitively over time. The study also incorporates literature on educational technology and digital behavior to address learning dynamics in the modern era. This body of literature provides insight into how digital environments, neurotechnology, and changes in learner behavior influence attention, motivation, and cognitive engagement, thereby shaping contemporary educational contexts [23], [24].

Table 2. Research Methodology

Component	Description
Research Approach	Qualitative descriptive study based on extensive literature review
Research Focus	Conceptual, philosophical, and theoretical analysis of neuroscience and Islamic education
Research Orientation	Interpretive, emphasizing meanings, ideas, and conceptual patterns
Primary Data	Qur'anic verses on reason, cognition, and learning processes
Normative Framework	Qur'anic perspectives guide educational and cognitive interpretation
Secondary Data	Classical and contemporary Islamic educational literature
Key Thinker	Ibn Sina's theory of intellect, soul, perception, memory, and knowledge
Neuroscience Sources	Studies on memory, emotion regulation, neuroplasticity, and learning
Contemporary Context	Educational technology, digital behavior, and modern learning environments
Data Reduction	Selection of literature relevant to cognition and education
Data Categorization	Thematic grouping of cognition, ethics, and integration issues
Data Synthesis	Thematic synthesis to build an integrative educational framework
Research Outcome	Holistic model integrating neuroscience and Islamic education

Data analysis is conducted through several stages. First, data reduction is applied to select materials that are most relevant to the research focus. Second, thematic categorization is used to classify issues related to cognition, learning, ethics, and educational integration. Finally, a thematic synthesis is undertaken to draw analytical conclusions and construct a comprehensive framework for integrating neuroscience and Islamic education through the intellectual contributions of Ibn Sina. This methodological process enables a coherent and holistic understanding of the subject matter [25], [26].

RESULTS AND DISCUSSION

Contemporary Issues in Islamic Education

The findings indicate that Islamic education curricula still tend to emphasize memorization rather than higher-order thinking skills. While memorization plays an important role in preserving religious texts, contemporary educational challenges require curricula that are value-based, adaptive to scientific developments, and capable of fostering critical thinking and problem-solving skills. In this context, Ibn Sina's educational philosophy is highly relevant. He emphasized that education should activate al-'aql al-fa'āl (the active intellect), enabling learners to understand causality, analyze reality, and generate new knowledge. Education, therefore, should not merely store information in memory but cultivate intellectual engagement and reasoning. This perspective aligns closely with modern competency-based and science-oriented curriculum reforms, suggesting that Islamic education can evolve without abandoning its intellectual heritage [27], [28].

Digitalization and Challenges of Modern Learning

Digital technology offers significant opportunities for Islamic education, including broader access to knowledge and innovative learning methods. However, the results also reveal serious risks, such as exposure to misinformation, digital addiction, reduced depth of understanding, weakened concentration, and shortened attention spans. Ibn Sina's concept of al-intibāh (focused attention) as a prerequisite for memory formation (takhayyul and tadhakkur) is particularly relevant in this context. When attention is fragmented, the processes of storing and recalling information become ineffective. This insight resonates with contemporary neuroscience findings on the role of the prefrontal cortex in attention control. Consequently, Islamic education must promote Islamic digital literacy and media ethics to ensure that technology enhances, rather than undermines, cognitive and moral development [29], [30].

Identity Crisis and Moral Values

Globalization and cultural homogenization have contributed to weakening moral commitment and identity among learners. The results highlight the need for Islamic education to strengthen character values such as integrity, empathy, trustworthiness, and social responsibility. Ibn Sina argued that morality does not emerge instantaneously but is cultivated through riyāḍah al-nafs (discipline of the soul) and the strengthening of will (al-irādah). Education must therefore integrate habituation, moral reasoning, and exemplary conduct. This approach supports the formation of a stable identity that enables learners to navigate multicultural and global environments without losing ethical grounding [31], [32].

Ethical and Social Challenges

Contemporary issues such as artificial intelligence, misinformation, data security, and environmental crises demand the application of Qur'anic values, including justice, compassion, trust, and the protection of intellect (ḥifẓ al-'aql). Ibn Sina regarded the intellect as a noble faculty responsible for discerning truth and falsehood. Accordingly, the ethical use of technology should aim to preserve mental clarity rather than distort it. This reinforces the importance of digital ethics within Islamic education, particularly in multicultural contexts where information flows rapidly, and ethical boundaries are often blurred [33], [34].

Contemporary Issues in Neuroscience

The results reveal that neuromyths such as the simplistic division of the brain into "left-brain" and "right-brain" learners remain widespread in educational discourse. These misconceptions lead to inappropriate teaching methods, biased expectations of learners' abilities, and distorted educational practices. Ibn Sina rejected simplistic views of cognition and instead conceptualized the human mind as an integrated system in which sensory perception, imagination, memory, and intellect work together. This holistic perspective is consistent with modern neuroscience, which emphasizes the integrative functioning of the brain and rejects rigid compartmentalization [35], [36].

Biological Reductionism

Another critical issue identified is biological reductionism, which reduces human beings to mere neural activity. Islamic education fundamentally rejects this view, recognizing humans as possessing intellect, will, heart, and spiritual dimensions. Ibn Sina strongly affirmed that the rational soul (al-nafs al-nāṭiqah) transcends bodily materiality. While biological processes are essential, they are insufficient to explain human dignity and moral responsibility. Integrating this perspective helps maintain a balanced relationship between neuroscience and Islamic values [37], [38].

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Neuroscience, Emotion, and Morality

Neuroscientific research demonstrates a strong relationship between neural activity and moral decision-making. However, Islamic education views morality as a synthesis of intellect, emotion, and spiritual values. Ibn Sina described moral development as the harmony between reason (al-'aql), emotional power (al-quwwah al-ghaḍabiyyah), and rational control. Emotions are important, but must be guided by reason. This framework enriches contemporary discussions on moral education by offering a multidimensional understanding of ethical behavior [35], [39].

Neuroeducation and Learning

Neuroscience confirms that emotions strengthen memory, the brain changes through neuroplasticity, and meaningful learning is more effective than rote repetition. Ibn Sina anticipated these ideas by emphasizing that emotions reinforce memory traces (rusūkh al-ma'rifah) and that repeated practice (tikrār) strengthens mental connections. These principles are highly relevant for Qur'anic learning, moral education, and character development [40].

Neuroethics and Neural Technology

Advances in neurotechnology raise ethical concerns such as cognitive privacy, brain stimulation in children, enhancement technologies, and motivational manipulation. Islamic education must address these issues through the framework of maqāṣid al-sharī'ah, particularly the protection of intellect. Ibn Sina's view of the intellect as the core of human dignity provides a strong philosophical foundation for Islamic neuroethics [41].

Integration of Islamic Education and Neuroscience

The integration of Islamic education and neuroscience does not imply abandoning Islamic identity or uncritically accepting scientific claims. Rather, it requires a balanced framework grounded in revelation, reason, and science. The results suggest several integrative models: value-based and neuroscience-informed curricula, neuroscience-oriented Qur'anic learning, Islamic–neuroscience learning environments that minimize digital distraction, and humanistic-Islamic approaches to learning disorders. Overall, this integration enhances educational effectiveness, strengthens moral identity, and enables Islamic education to respond comprehensively to multicultural and digital challenges [42], [43].

Table 3. Results and Discussion

Issue	Key Findings	Educational Implications
Curriculum Orientation	Islamic education still emphasizes memorization over critical thinking	Curricula should promote reasoning, causality, and problem-solving
Ibn Sina's Educational Thought	Learning activates the active intellect and intellectual engagement	Education should move beyond rote learning
Digital Learning	Technology expands access but reduces focus and depth	Digital literacy and ethical media use are essential
Attention and Cognition	Fragmented attention weakens memory and understanding	Focused learning environments must be cultivated
Moral and Identity Crisis	Globalization weakens moral commitment	Education must strengthen character and ethical identity
Moral Formation	Ethics develops through discipline and habituation	Moral education requires consistent practice and exemplars
Ethical Challenges	AI, misinformation, and data issues threaten cognition	Islamic ethics should guide technological use
Neuromyths	Simplistic brain theories distort education	Holistic cognition must be emphasized

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Reductionism	Humans reduced to neural processes	Spiritual and moral dimensions must be preserved
Emotion and Morality	Emotions influence moral decisions	Reason must guide emotional responses
Neuroeducation	Meaningful and emotional learning strengthens memory	Learning should be contextual and value-oriented
Neuroethics	Neurotechnology raises ethical risks	Protection of intellect is a core educational responsibility
Integration Model	Islamic values and neuroscience can be harmonized	Balanced integration enhances effectiveness and identity

Analysis

The integration of Islamic education and neuroscience, as articulated in the analyzed text, reflects a critical response to contemporary educational challenges in multicultural and digitally mediated contexts. The analysis demonstrates that both disciplines share a common objective: the holistic development of human beings. Neuroscience contributes empirical insights into cognitive processes such as memory, attention, emotion, and neuroplasticity, while Islamic education provides ethical, spiritual, and philosophical foundations that define the purpose and direction of learning. When examined together, these perspectives reveal complementary strengths rather than epistemological conflict [44], [45].

A central analytical finding is the relevance of Ibn Sina's cognitive philosophy as a mediating framework between classical Islamic thought and modern neuroscience. Ibn Sina's conception of the rational soul (al-nafs al-nāṭiqah), stages of intellect, and the interaction between sensory perception, imagination, memory, and reason anticipates many principles later confirmed by neuroscience. This alignment challenges the assumption that brain-based education is a purely modern construct and highlights the intellectual continuity between Islamic epistemology and contemporary cognitive science [46], [47].

The analysis also reveals persistent tensions in current educational practice, particularly the dominance of memorization-oriented curricula and the uncritical adoption of neuroscientific concepts. Neuroscience, when simplified into neuromyths or reduced to biological determinism, risks undermining the ethical and spiritual dimensions of education. Islamic education addresses this risk by emphasizing moral agency, intentionality, and the cultivation of character through disciplined practice and reflective reasoning. In multicultural societies, this ethical grounding becomes essential for navigating diversity, digital information overload, and moral ambiguity.

Furthermore, the study underscores the importance of addressing neuroethical concerns within Islamic education. Issues such as cognitive enhancement, data privacy, artificial intelligence, and emotional manipulation require normative guidance rooted in values such as justice, trustworthiness, compassion, and the protection of intellect (ḥifẓ al-'aql). Ibn Sina's view of the intellect as the locus of human dignity provides a philosophical basis for evaluating technological interventions critically rather than rejecting or accepting them unconditionally. Overall, the analysis indicates that an integrative model of Islamic education and neuroscience can enhance learning effectiveness, strengthen moral identity, and support inclusive education in multicultural environments. Such integration does not dilute Islamic values but rather reaffirms them within contemporary scientific discourse. By balancing empirical knowledge with ethical and spiritual reflection, Islamic education can respond adaptively to the challenges of the neurodigital era while maintaining its humanistic and transcendent orientation [48].

CONCLUSION

Islamic education and neuroscience are not two disciplines that contradict each other, but two scientific fields that have a strong common ground and integration potential. Neuroscience provides a scientific understanding of brain mechanisms, learning processes, memory, emotions, and human behavior, which is particularly relevant to improving learning

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effectiveness. On the other hand, Islamic education offers a framework of values, ethics, and spirituality that serves as a normative foundation in guiding the direction and purpose of the utilization of science and technology. Therefore, the integration between Islamic education and neuroscience is a necessity in responding to educational challenges in the neurodigital era. The results of this study show that neuroscience can contribute significantly to the development of Islamic education learning strategies, especially in understanding the characteristics of students, cognitive processes, and emotional factors that affect learning success. However, the utilization of neuroscience cannot be done in a reductionistic manner that views humans solely as biological entities. Without a foundation in values and ethics, the neuroeducational approach has the potential to ignore the spiritual and moral dimensions that are at the core of the goals of Islamic education. In this context, Islamic values play an important role as a counterbalance so that neuroscience-based innovation remains oriented towards the formation of a whole human being. The integration of Islamic education and neuroscience also demands a holistic conceptual framework. Classical Islamic thought, such as Ibn Sina's idea of reason and rational soul, can serve as an epistemological bridge between the Islamic scientific tradition and modern scientific findings. This approach allows for the birth of a learning model that is not only based on scientific evidence but also in harmony with the principles of spirituality, ethics, and humanity. Thus, Islamic education that is integrated with Neuroscience has the potential to give birth to a scientific education system, because it is based on an empirical understanding of the learning process; spiritual, because it remains oriented to divine values; humanistic, because it views students as dignified subjects; and adaptive to the development of the neurodigital era. In the future, the development of Islamic education needs to continue to encourage interdisciplinary dialogue so that learning innovations can take place responsibly, ethically, and relevant to the challenges of the times, without losing their identity and main goals.

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Author Contribution

The author solely conceptualized the study, conducted the literature review, performed data analysis, and drafted the manuscript. All interpretations, arguments, and conclusions presented in this article are the author's independent scholarly contributions, developed through critical engagement with classical Islamic thought and contemporary neuroscience literature.

Conflicts of Interest

The author declares no conflicts of interest related to this study. The research was conducted independently without any financial, institutional, or personal relationships that could be perceived as influencing the interpretation, analysis, or presentation of the findings and conclusions presented in this article.

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