

## INTEGRATION OF NEUROSCIENCE IN ISLAMIC RELIGIOUS EDUCATION LEARNING: STRATEGIES TO OPTIMIZE BRAIN POTENTIAL AND CHARACTER FORMATION OF STUDENTS

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### Abstract

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| <p><i>Article History</i><br/><i>Received :20-06-2026</i><br/><i>Revised :01-09-2026</i><br/><i>Accepted :24-09-2026</i></p> <hr/> <p><b>Keywords:</b><br/><i>Neuroscience;</i><br/><i>Islamic Religious Education;</i><br/><i>Brain-Based Learning;</i><br/><i>Character Education;</i><br/><i>Emotion Regulation;</i></p> | <p><i>Neuroscience provides a new perspective in understanding the learning process and character formation in Islamic Religious Education (PAI). This article aims to analyze the integration of neuroscience principles in PAI learning to optimize the potential of the brain and strengthen the religious character of students. This study uses a literature study method with a qualitative approach through the analysis of 20 source literature, consisting of journal articles, books, and scientific documents published in the last five years. The literature was selected based on its relevance to the themes of neuroscience, brain-based learning, Islamic education, and character education. The data were analyzed using content analysis and thematic synthesis. The results of the study show that the integration of neuroscience can help design PAI learning that pays attention to the cognitive, emotional, and psychomotor processes of students. The main strategies found include the creation of a positive learning atmosphere, the association of religious materials with meaningful experiences, the example of teachers, the use of multisensory stimulation, the use of Islamic stories, and the strengthening of emotion regulation. The synthesis of the study shows that PAI learning needs to develop the intellectual abilities as well as the spiritual character of students. Therefore, it is necessary to improve neuroscience literacy for teachers, develop practical learning models, and further empirical research.</i></p> |
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### Introduction

The development of science in the 21st century is marked by increasing cross-disciplinary integration, including the meeting between neuroscience and education. Neuroscience, as a science that examines the nervous system, brain, and its relationship to learning behavior and processes, provides a new empirical

basis for the development of learning theories and practices. In this context, Islamic Religious Education (PAI) faces both challenges and opportunities to utilize neuroscience findings to strengthen the internalization of values, spiritual development, and character formation of students (Zulkifli et al., 2025).

In Indonesia, the urgency of character strengthening is emphasized through the Character Education Strengthening (PPK) policy and the Pancasila Student profile, which is in line with the goal of Islamic education in forming kamil people with noble, intelligent, and balanced character. However, various studies show that PAI learning still tends to be oriented towards cognitive aspects, dominated by lecture methods, and has not optimally touched the emotional dimensions and spiritual experiences of students. In fact, neuroscience emphasizes that meaningful learning requires the comprehensive involvement of the brain system—including cognitive, affective, and psychomotor aspects supported by a positive emotional environment (Abdul Khamid et al., 2022).

A number of advanced studies have strengthened the relevance of neuroscience in Islamic education. Bukhari (2026) developed an Islamic neuro-pedagogical framework based on neuroembryology and brain-based learning that is integrated with the values of fitrah, tarbiyah, ta'dib, tazkiyah, and morals. Other research shows that the neuroscience approach in PAI is able to strengthen religious character through the development of emotional intelligence and a harmonious relationship between the brain, heart, and soul. In addition, the application of brain-based learning has been proven to improve critical thinking skills, change mindsets, and improve students' religious behavior.

The integration between Islamic science and modern science, especially neuroscience, further emphasizes the importance of a learning approach that is in harmony with the way the brain works. In this context, neuroeducation or brain-based learning emphasizes that the effectiveness of learning is highly determined by the suitability of strategies with the working mechanisms of the nervous system. PAI, which has a mandate to form students of faith and noble character in the midst of social and technological changes, requires an approach that is not only normative, but also scientific, contextual, and brain-friendly (Zulkifli et al., 2025).

Formally, PAI is a compulsory subject at various levels of education in Indonesia and is an important part of strengthening character. However, its implementation still faces various obstacles. From the internal side, the limitations of teachers' pedagogic competence, the dominance of lecture methods, and the lack of learning innovation are the main challenges. From the external side, the influence of globalization, the development of digital technology, the social environment, and the weak role of the family also affect the effectiveness of character training (Abdul Khamid et al., 2022).

At the classroom level, PAI learning generally still focuses on mastering materials such as the pillars of faith, the pillars of Islam, and fiqh, while aspects of value appreciation and habituation of behavior have not been developed systematically. Evaluations dominated by written tests further strengthen cognitive orientation, so that learning success is often measured by the ability to answer questions, not by changes in attitudes and behaviors. In fact, the main goal of PAI is to form students who not only "know", but are also able to practice Islamic teachings in daily life. From a neuroscience perspective, the learning process and character formation are closely related to neuroplasticity, which is the brain's

ability to form and strengthen connections between neurons based on experience. Learning experiences that are repetitive, meaningful, and involve emotions will form stable neural patterns, which ultimately affect the way we think, feel, and act. Thus, character education is not enough through behavioral conditioning, but requires the engineering of learning experiences that are able to gradually change the structure and function of the brain.

Integrative studies between neuroscience and Islamic education show that there is a harmony in context. Concepts such as 'aql, dhikr, tafakkur, muhasabah, and tazkiyah have a correlation with brain mechanisms in modern neuroscience. For example, dhikr and solemn prayer activities are related to the regulation of emotions, attention, and memorization, while muhasabah and tafakkur are related to the function of the prefrontal cortex in self-reflection and moral decision-making. Field research also shows that the integration of worship practices such as prayer, dhikr, and Qur'an recitation makes a significant contribution to strengthening faith and changing students' behavior. However, some studies still focus on biological aspects without developing systematic practical applications in learning. In addition, technology-based neuroscience approaches often face cost and accessibility constraints, so a simpler but still scientifically based model is needed.

In response to this, a number of studies have begun to develop Islamic neuro-pedagogical models. Bukhari (2026) shows that brain development from embryonic to adult life is closely related to learning readiness, emotional regulation, and character formation. These findings strengthen the alignment between brain-based learning and Islamic educational values such as fitrah, tarbiyah, ta'dib, and tazkiyah, which are then formulated within a holistic learning framework. At an early age, the neuroscience approach in PAI has also proven to be important for building a religious foundation from the beginning. Early Studies (2023) affirms that neuroscience has a "trace" in the Islamic tradition and that its integration is no different from the Qur'an, but rather enriches the understanding of how Islamic teachings work at the biological and psychological levels of humans.

The novelty of this research lies in the effort to integrate the principles of neuroscience with the goals, values, and learning practices of Islamic Religious Education in a more systematic manner. Previous research generally discusses neuroscience in Islamic education conceptually or focuses on the application of certain learning models, such as brain-based learning, inquiry learning, and quantum learning. Different from these studies, this article compiles an integrative synthesis that connects brain work mechanisms, neuroplasticity, emotion regulation, internalization of Islamic values, and the formation of religious character. This article also offers a neuroscience-based PAI learning framework consisting of four stages, namely cognitive-emotional activation, meaningful engagement, spiritual reflection, and character-based action. Thus, the contribution of this article lies not only in explaining the relationship between neuroscience and PAI, but also in the formulation of learning strategies that link brain development with the process of forming students' faith, morals, and positive habits.

In the era of the industrial revolution 4.0 and society 5.0, PAI's challenges are increasingly complex due to digitalization and changes in social interaction patterns. Students are exposed to various digital stimuli that affect the way the brain processes information. Therefore, PAI needs to develop learning that is not

only interesting in presentation, but also able to improve high-level thinking skills and digital literacy, without neglecting spiritual depth. Irfanda's research (2025) shows that neuroscience-based learning media is effective in helping students understand religious concepts critically and creatively.

Based on this description, it can be seen that there is a gap between the ideal goals of PAI that are oriented towards character formation and learning practices that are still dominant cognitive and less innovative. On the other hand, neuroscience offers opportunities to design more effective and science-based learning approaches. This gap is the basis for research with a focus on the integration of neuroscience in PAI learning to optimize the brain potential and character formation of students.

Departing from this background, the formulation of this research problem includes: (1) how the theoretical and philosophical foundations of the integration of neuroscience and PAI in learning and character formation; (2) how neuroscience-based PAI learning strategies and models are able to optimize brain potential while strengthening religious character; and (3) how the practical implementation and challenges of such integration for teachers, educational institutions, and policy makers are concerned.

In line with that, this study aims to: (1) analyze the conceptualized, normative, and empirical foundations of the integration of neuroscience and PAI; (2) develop neuroscience-based learning strategies and models; and (3) identify practical implementation and policy recommendations. Theoretically, this research is enriched by the study of Islamic education through an interdisciplinary approach. Practically, the results of this research are expected to be a reference in the development of more effective PAI learning to form a generation of Muslims who are intelligent, emotionally mature, and spiritually strong.

### **Research Methods**

This study uses a qualitative approach with a library research design. This design was chosen because the research aims to analyze the concepts, findings, and strategies of integrating neuroscience in the learning of Islamic Religious Education (PAI), rather than testing hypotheses statistically. This study focuses on the relationship between brain work mechanisms, learning processes, internalization of Islamic values, and the formation of students' character.

Research data was obtained through a literature search on Google Scholar. Based on the results of the search and selection, there are 20 sources listed in the bibliography, consisting of journal articles, conference proceedings, and supporting scientific sources. Of these, 19 sources are used as the main literature, while one source, namely Subagiya (2023), is used as a methodological reference regarding literature research.

The search was conducted using the keywords "Islamic educational neuroscience", "Islamic education neuroeducation", "Islamic religious education", "Islamic neuro-pedagogy", and "neuroscience-based religious character formation". These keywords were used singly or in combination with AND and OR search operators to obtain relevant literature.

The literature was selected based on inclusion criteria, namely: (1) discussing neuroscience, neuroeducation, brain-based learning, PAI, or character education; (2) having a relationship with the learning process or character

formation of learners; (3) being published in the 2021–2026 range, with priority in the last five years; and (4) coming from reputable journals, proceedings, or academic sources. Literature that did not fit the research focus or did not have adequate bibliographic information was excluded from the primary analysis.

Data analysis was carried out through content analysis and thematic synthesis. Each literature was read in depth and recorded in a matrix containing the author's name, year of publication, focus of study, research method, main findings, and relevance to the integration of neuroscience and PAI. Furthermore, the findings were grouped into four main themes, namely: (1) brain working mechanisms and neuroplasticity in learning; (2) the relationship between neuroscience and Islamic educational goals; (3) neuroscience-based PAI learning strategies; and (4) the contribution of neuroscience to the formation of religious character.

The final stage is carried out by comparing findings between sources to identify similarities, differences, patterns, and research gaps. The results of the comparison are then synthesized into a conceptual framework of neuroscience-based PAI learning which includes cognitive-emotional activation, meaningful engagement, spiritual reflection, and character-based action. The validity of the analysis is maintained through triangulation of sources by comparing findings from various publications obtained through Google Scholar.

## **Discussion**

### **Integration of neuroscience and Islamic Religious Education in character formation**

The literature shows that neuroscience and Islamic Religious Education (PAI) have complementary orientations, especially in the formation of students' characters. Neuroscience focuses on brain mechanisms and nervous systems as the basis for behavioral biology, emotions, and learning processes, while Islamic education encourages the formation of Muslim personalities who have faith and noble character. In the study "character education as brain education", it is emphasized that character education that only relies on external behavioral approaches tends not to produce lasting changes, because it does not touch the structure and working patterns of the brain. On the other hand, the neuroscience approach views students as active subjects who are able to form strong character identities through biological processes at the neural level (Sari et al., 2024).

In line with that, the study "Character Education as Brain Education" criticizes the dominance of behavioristic approaches in Islamic educational practices, which emphasize environmental control through reward and punishment systems. Although this approach is effective in creating momentary gratification, the impact often does not last when external control is lost. Neuroscience shows that strong character is formed through internal changes in mindsets and emotions, which trigger the reorganization of neural networks. In this context, the neuroscience approach is more in line with PAI's goal, which is to foster faith and piety as mental forces that drive behavior, rather than just formal adherence to rules (Asman et al., 2021).

Recent research also confirms that teachers have a strategic role in building an "educational construct" that has a direct impact on the way students' brains educate and interpret religious values. Efforts to instill love for Allah and the

Messenger, cultivate godly character, and create a class atmosphere full of piety and peace are not only theological, but also neuropsychological. Positive emotional experiences in worship practices, prayer, and religious interactions will form strong neural associations between feelings of comfort and religious activity. As a result, learners tend to maintain these behaviors consciously and voluntarily.

In the perspective of spiritual neuroscience, students are no longer seen as passive objects formed by the environment, but as subjects who are able to build and even influence their environment when they have a strong character identity. This identity is formed when Islamic values are not only understood cognitively, but have been internalized in the structure of consciousness and the brain's work patterns. At this stage, students are able to maintain their integrity even though they are in a less supportive environment. This perspective shifts the orientation of PAI from just fulfilling to the process of internalizing values and actively transforming oneself (Asabiq, 2024).

Within the framework of Islamic education, the concepts of tarbiyah, ta'dib, tazkiyah, and moral training can be understood as a process that gradually strengthens neural pathways through repetitive and meaningful learning experiences. Neuroscience findings suggest that behavioral changes can be designed through systematic educational stimulation, resulting in a more permanent reorganization of the nervous system. Thus, the development of religious character in PAI is essentially an integration between value education and "brain education", where the practice of worship, strengthening social morals, and managing emotions play a role as neuroplasticity mechanisms that shape the identity of Muslims who believe and have morals.

### **The role of neuroscience-based learning in PAI**

Brain-based learning/neuroeducation departs from the assumption that the learning process will be optimal when it is aligned with how the brain works in processing, managing emotions, and forming long-term memories. In the context of Islamic Religious Education (PAI), this approach demands a shift from linear, one-way, and memorization-oriented learning to learning that is interactive, contextual, and involves emotional dimensions and spiritual experiences. The implementation of neuroeducation in PAI generally follows a holistic learning cycle that includes four stages: cognitive-emotional activation, meaningful engagement, spiritual reflection, and character-based action.

In the cognitive-emotional activation stage, teachers begin learning through stimuli that are close to the learner's experience, such as real-life narratives, short visual media, or reader questions that touch on rational and emotional aspects. This stage functions to activate the limbic system and increase the readiness of the prefrontal cortex, so that students are more focused and ready to receive the material. If this stage is ignored and direct learning is dogmatic, information is less likely to be processed in depth because the cognitive condition of students is not optimal (Luthfiyani et al., 2024).

The next stage is meaningful involvement, where students are involved in activities that include PAI material with real-life realities. The form of activity can be in the form of case discussions, simulations, educational games, or social projects based on Islamic values. A cooperative approach based on neuroscience has been proven to be able to improve critical thinking skills, suppress

egocentrism, and foster mutual respect. This involvement activates various brain areas simultaneously, especially association areas that integrate cognitive and emotional aspects, thereby strengthening the process of internalizing values.

Spiritual reflection is a key stage in PAI neuroeducation. In this phase, students are invited to do muhasabah, tadabbur, and personal interpretation of the material studied. "Deep reflection" has been proven to strengthen long-term memory while connecting knowledge with self-identity and spiritual beliefs. The practice can be in the form of writing a reflective journal, after-worship devotional, or guided discussions about religious experiences. When done consistently, reflection helps to form a framework of thinking that places Islamic values as the basis for interpreting life experiences.

The final stage is character-based action, which is the application of real values in daily life. In the perspective of neuroscience, learning is incomplete without repetitive practice that strengthens new neural pathways. In PAI, the form of action can be in the form of social activities, community service, alms programs, or environmental concern that is explicitly associated with the values of faith and piety. The repetition of these actions strengthens the connection between knowledge, emotions, and behavior, so that the learned values develop into relatively stable habits (Sari NN, 2023).

### **Character education as brain education in an Islamic perspective**

A number of studies position character education in Islam as a form of "brain education", which is a learning process that consciously shapes mindsets and habits through changes in the nervous system. The spiritual perspective of neuroscience in Islamic education shows that character approaches that rely only on environmental control and reinforcement of external behaviors often do not produce characters that last long in real life. On the contrary, when it comes to learning the dimensions of awareness, reflection, and internalization of values, students not only display good behavior, but also build character identities that are able to influence their environment.

Within this framework, religious character education can be understood as "brain education" based on the values of revelation. Research that links character values to brain activity shows that religious attitudes, mutual cooperation, nationalism, and moral integrity have a correlation with the work of several brain areas, such as the temporal lobe, girus cingulatus, basal ganglia, and prefrontal cortex. For example, attitudes of tolerance and the ability to appreciate differ in relation to the regulation of emotions involving the limbic system, while honesty and trust are related to the moral decision-making function of the prefrontal cortex (Armando, 2024).

In the practice of PAI, various character competencies such as religious observance, honesty, responsibility, tolerance, anti-violence, friendship, and concern for the environment cannot only be understood from the point of view of fiqh or morals. These values can also be described as the process of how repetitive experiences are "implanted" in the neural network through consistent practice. The neuroscience approach explains that any good action performed with awareness will strengthen synaptic connections, especially when accompanied by positive emotional experiences such as calmness or contentment. This condition encourages the brain to return to the same behavior later in life.

Thus, moral habituation in PAI is basically a neuroplasticity process that gradually strengthens the neural pathways towards the formation of pious characters (Sidah, 2022). This is in line with neuroscience principles that affirm that sustainable character change is not enough through momentary advice or punishment, but requires the engineering of consistent and meaningful learning experiences and exercises.

### **Practical strategies for integrating neuroscience in PAI learning**

Based on the synthesis of various studies, there are a number of practical strategies that PAI teachers can apply to integrate neuroscience principles into learning.

First, teachers need to build a "safe emotional climate" in the classroom. A learning environment filled with disproportionate threats, threats, or punishments can trigger stress responses and inhibit the function of the prefrontal cortex, which plays a role in critical thinking and moral decision-making. Conversely, when students feel accepted and valued, the limbic system is in a more conducive condition for learning, so that the material of faith, worship, and morals is easier to understand and internalize (Luthfiyani, 2024).

Second, the optimization of learning motivation needs to be based on an understanding of how the brain responds to meaning, challenges, and rewards. Neuroscience shows that students are more responsive to learning that is relevant to their life goals. Therefore, PAI teachers need to allude to the material with the reality of life, for example by emphasizing that the values of honesty, discipline, and hard work not only have an impact on academic and career success, but are also part of efforts to achieve God's pleasure. Positive reinforcement, constructive feedback, and recognition of students' efforts also play a role in activating the system that rewards the brain that strengthens learning motivation.

Third, in terms of methods, the application of a neuroscience-based cooperative learning model can be an effective alternative. Structured group activities encourage interaction, cooperation, and empathy. Research shows that this approach is able to improve critical thinking skills while strengthening students' social values and commitment. From a neuroscience perspective, interaction groups provide space for the brain to process other people's points of view, manage differences, and build a sense of belonging to the community, all of which contribute to the formation of social character (Assabiq, 2024).

Fourth, teachers need to integrate emotion regulation exercises in PAI learning. Practice can be in the form of basic emotion recognition, associating emotional states with religious values such as patience, gratitude, and sincerity, as well as simple exercises such as breathing combined with dhikr or prayer in certain situations. Research findings show that learners who are trained to consciously manage emotions and stress tend to have better emotional skills, which ultimately supports the consistency of religious behavior.

Fifth, the development of the PAI curriculum needs to consider the stages of cognitive and neurobiological development of students (Falahuddin, 2025). Material that is too abstract and not in accordance with the stage of development is often only memorized without being understood in depth. By understanding brain development, teachers and developers can arrange learning gradually from concrete to abstract, from practice to concept, and from narrative to argument so

that it is in harmony with students' learning readiness at each age phase.

### **Neuroscience-based PAI concept model and its impedance**

Various studies that develop neuroscience-based PAI learning basically lead to a single conceptual framework that can be called "Islamic neuro-pedagogy". This framework integrates four main components, namely: (1) the values and goals of PAI that are oriented towards faith, piety, and noble morals; (2) educational neuroscience principles such as neuroplasticity, the role of emotions, multisensory approaches, and reflection; (3) learning design that includes methods, media, and classroom management; and (4) outputs in the form of religious characters that are reflected in the real lives of students (Ulfawati, 2024).

Research that specifically develops a neuroscience-based PAI model emphasizes the importance of integrating cognitive, affective, and psychomotor aspects in each stage of learning (Afriko et al., 2024). The application of meaningful learning, positive emotional interactions, multisensory stimulation, reflection, and experiential-based approaches have been proven to make PAI learning more contextual and effective in shaping morals. Thus, Islamic neuro-pedagogy not only answers why students need to have noble morals, but also explains how brain processes can be directed so that these values become part of embedded habits.

In line with that, studies that highlight the reconstruction of the PAI method through a neuropsychological approach emphasize the need for a holistic approach that integrates the cognitive and spiritual dimensions (Hidayatulloh, 2025). Religious education does not stop at presenting theological concepts, but needs to manage emotions and spiritual experiences in a structured manner. Methods such as experiential learning and "deep reflection" are considered effective because they involve complex mental processes while strengthening emotional memory. This integration allows the formation of learners who are not only intellectually superior, but also morally and spiritually mature.

In addition, case studies in various Islamic educational institutions show that the application of neuroscience in PAI contributes to students' adaptability to contemporary social challenges (Kartika, 2025). Participants educated with religious characters formed through this approach tend to be better able to manage pressures, face social conflicts, and respond critically to the flow of digital information without losing Islamic principles. These findings show that the integration of neuroscience in PAI is not only relevant at the grade level, but also important as an educational strategy in responding to the dynamics of the times.

The novelty of the concept offered lies in the incorporation of the principle of neuroplasticity with the concept of Islamic education, namely tarbiyah, ta'dib, tazkiyah, and habituation of morals. Religious knowledge is not positioned as information that is only memorized, but as an experience that is understood, felt, contemplated, and realized through repetitive actions. Thus, this article offers the concept of Islamic neuro-pedagogy, which is a PAI learning approach that harmonizes brain development, emotional experiences, spiritual reflection, and character practice in a series of learning. The concept expands the study of neuroscience and PAI from theoretical discussions to a more systematic and applicable learning framework.

The contribution of this article lies in the preparation of an integrative

synthesis that connects the working mechanisms of the brain with the goals of Islamic education. Neuroscience-based PAI learning is not enough to adapt teaching methods to the way the brain works, but must also direct the learning process towards internalizing values, regulating emotions, habituating worship, and forming morals. Based on this synthesis, this article formulates four stages of learning, namely cognitive-emotional activation, meaningful engagement, spiritual reflection, and character-based action.

However, these studies still tend to stand alone. Conceptual studies have not been fully linked to operational learning steps, while research on learning models has not explained much about how cognitive, emotional, spiritual, and behavioral processes are interconnected in character formation. In addition, previous research has generally discussed neuroscience as the basis of learning or as a character-building approach, but has not formulated a PAI learning flow that integrates the two aspects in its entirety.

A synthesis of 19 main literature shows three trends in previous research. First, some studies discuss the relationship between neuroscience and Islamic education conceptually through the concepts of neuroplasticity, brain development, emotions, and character formation (Asman et al., 2021; Sari et al., 2024; Zulkifli et al., 2025). Second, other studies focus on the application of specific learning models, such as brain-based learning, inquiry learning, cooperative learning, and quantum learning in PAI (Luthfiyani et al., 2024; Rukmini et al., 2024; Ulfawati et al., 2024). Third, several studies emphasize the role of emotion regulation, teacher example, spiritual experience, and moral habituation in the formation of students' religious character (Huda, 2022; Sari et al., 2023; Sidah & Suyadi, 2022). Synthesis of Findings, Contributions, and Concept Novelty.

## **Conclusion**

Based on the results of literature review and synthesis, the integration of neuroscience in Islamic Religious Education (PAI) learning can optimize students' cognitive, emotional, and spiritual processes while strengthening the formation of religious character. Neuroscience-based PAI learning needs to be designed through meaningful learning experiences, positive emotion management, multisensory stimulation, spiritual reflection, teacher example, and behavioral habituation. This process allows values such as honesty, responsibility, tolerance, and care to develop into part of students' identities, not just knowledge or obedience to rules.

The main contribution of this article is the formulation of the concept of Islamic neuro-pedagogy, which is an approach that connects the principles of neuroplasticity and brain learning mechanisms with the values of tarbiyah, ta'dib, tazkiyah, and moral formation. This concept offers four stages of PAI learning, namely cognitive-emotional activation, meaningful engagement, spiritual reflection, and character-based action. However, the application of this concept still requires empirical testing through experimental, quasi-experimental, or mixed methods research so that its effectiveness on students' learning outcomes and religious character can be proven more strongly.

## BIBLIOGRAPHY

- Abdul Khamid, Mushbihah Rodliyatun. 2022. Pengaruh Model Pembelajaran Brain Based Learning Terhadap Kegiatan Belajar Mata Pelajaran Fiqh Siswa Kelas Vii Madrasah Tsanawiyah Al-Manar Kabupaten Semarang. *Jurnal Pendidikan Agama Islam Rabbani*, 3(1),135-149.
- Afriko, N., Lahmi, A., Dahlan, D., & Hakim, R. 2025. Integrasi Emosi dan Kerja Otak dalam Pendidikan Islam Berbasis Neurosains. *El-Banat: Jurnal Pemikiran dan Pendidikan Islam*, 15(1), 382-396.
- Armando Bima Putra, U. 2024. *Nilai-Nilai Penguatan Pendidikan Karakter Berbasis Neurosains dalam Pembelajaran Akidah Akhlak di SD Negeri Serayu. Konseling Islam: Jurnal Bimbingan Dan Konseling Islam*, Vol. 8, Tidak, 75-92.
- Asman, A., Suyadi, S., & Huda, M. 2021. Pendidikan karakter sebagai pendidikan otak: studi neurosains spiritual dalam pendidikan Islam. *Jurnal Tarbiyatuna* , 12 (2), 77-86.
- Assabiq, R. 2024. Neuropsikologi Pendidikan Islam: Upaya Rekonstruksi Metode Belajar PAI Melalui Proses Integrasi Potensi Kognitif Dan Spiritual Siswa. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(04), 234-264.
- Bukhari, B., Muksinin, M., Alkawadi, A., Musdalifa, D. H., Lahmi, A., & Julhadi, J. 2026. Integrating Neuroembryology into Islamic Education: A Brain Development-Based Neuro-Pedagogical Framework. *Ruhama: Islamic Education Journal*, 9(1), 30-47.
- Dini, P. A. U. Pembelajaran Berbasis Neurosains Dalam Pendidikan Anak Usia Dini.
- Helmi, T., Nasution, J. E., Rahman, A., Hamzar, A., & Yusuf, D. 2026. Implementation Of Neuroeducation In Islamic Religious Education And Its Implications For Spiritual Reflection And Character Building:-. *Edukasi Islami: Jurnal Pendidikan Islam*, 15(02), 547-560.
- Huda, F. I. H. 2022. Pembentukan Karakter Religius Berbasis Neurosains: Konstruksi Upaya Guru dalam Pembelajaran Pendidikan Agama Islam. *Jurnal Pendidikan Agama Islam Al-Thariqah*, 7(2), 491-502.
- Irfanda, H. 2025. Integrasi Neosains dalam Pendidikan Islam untuk Meningkatkan Iman Melalui Ibadah di SMAN 2 Pariaman. *Prosiding Biced* , 3 (1), 7-14.
- Kartika, D., & Nurjayanti, G. 2025. Brain-Based Learning dalam Pendidikan Islam Strategi Pembelajaran Berbasis Otak. *An-Nuha*, 5(3), 414-428.
- Lahmi, A., Dahlan, D., Hakim, R., & Prima, A. 2025. Meretas Jalan Pendidikan Islam Modern melalui Perspektif Neurosains. *Al Qodiri: Jurnal Pendidikan, Sosial Dan Keagamaan*, 23(2), 517-529.
- Luthfiyani, A., Ferdian, F., Suryana, E., & Suhono, S. 2024. Neuroscience In Islamic Religious Education Learning. *JMKSP (Jurnal Manajemen, Kepemimpinan, Dan Supervisi Pendidikan)*, 9(1), 153-166.
- Rukmini, RD, Sutarto, S., Sari, DP, & Nasution, AR. 2024. Model pembelajaran PAI berbasis neurosains: pembelajaran inkuiri. *Jurnal Penelitian Multidisipliner Inovasi Indonesia* , 2 (4), 35-43.
- Sari, N. N., & Fauziyah, N. 2023. October). Application of Neuroscience in Establishing Character Education in Early Children at Aisyiyah 06 Jaten Kindergarten Students. In *Proceedings International Conference on*

*Education Innovation and Social Science* (pp. 138-142).

- Sari, N., Sari, D. P., & Nasution, A. R. 2024. Pemahaman pada Neurosains pada Pendidikan Islam dan Hubungannya dengan Perkembangan Karakter. *Indonesian Journal of Multidisciplinary on Social and Technology*, 2(2), 28-33.
- Sidah, S. N., & Suyadi, S. 2022. Pengembangan HOTS Berbasis Neurosains Dalam Pembelajaran PAI. *Piwulang: Jurnal Pendidikan Agama Islam*, 4(2), 134-146.
- Subagiya, B. 2023. Penelitian kepustakaan (library research) dalam penelitian PAI. *Jurnal Pendidikan Islam*, 12, 43.