Neuroscience in Islamic Education: A Systematic Review of Implications for Memorization, Devotion, and Faith

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A B S T R A C T

The convergence between neuroscience and religious education opens up new perspectives for improving the effectiveness of Islamic Religious Education (IRE). This academic paper, based on a literature review, conducts a systematic review to analyse the implications of neuroscience findings on three main domains of IRE: memorisation of the Qur'an, concentration in worship, and strengthening of faith. The study uses a qualitative approach with a thematic synthesis method of relevant scientific literature. The results show that neuroscience concepts such as neuroplasticity and memory consolidation provide a strong foundation for refining the tahfiz methodology with material breakdown and spaced repetition techniques. Findings on attention regulation and the Default Mode Network identify that devotion can be trained through strategies to strengthen focus and reduce wandering thoughts. Meanwhile, understanding the mechanisms of belief formation emphasises the importance of an approach to teaching faith that integrates narrative, emotional experience, and practical application for deeper internalisation of values. This paper concludes that the integration of neuroscience into Islamic Education has the potential to produce more evidence-based, humane learning methods that have an impact on cognitive and affective levels. Its implementation requires curriculum adjustments, teacher training, and the transformation of learning management in Islamic educational institutions.

INTRODUCTION

The development of science in the 21st century is marked by the convergence of various disciplines, creating new perspectives in understanding complex phenomena, including religious and educational activities. One field that is developing rapidly and attracting a lot of attention is neuroscience, which studies the structure and function of the nervous system, especially the human brain. Advances in brain imaging technologies such as functional Magnetic Resonance Imaging (fMRI) and Electroencephalography (EEG) have opened a window to observe neural activity that occurs when humans think, feel, behave, and worship. These neuroscience findings have begun to be widely applied in the world of education, resulting in new approaches such as brain-based education, which aims to align pedagogical practices with the natural way the brain learns (Weker, 2016).

In the realm of Islamic Religious Education (IRE), there are several core practices that have very deep cognitive and affective dimensions, such as memorizing the Qur'an (tahfiz), performing worship with devotion, and understanding and internalizing faith. Until now, PAI teaching methodologies have largely been sourced from classical Islamic scientific traditions and the empirical experiences of educators. However, questions about how the neurocognitive process actually occurs when a student memorizes verses, or which parts of the brain are active when someone achieves devotion in prayer, are still often answered with a purely philosophical or Sufi approach (Huda & Widodo, 2022). This is where there is a gap between Islamic scientific tradition and modern scientific advances that can be brought together to enrich each other.

Neuroscience offers an empirical lens through which to review religious education practices. The concept of neuroplasticity, which is the brain's ability to change its structure and function throughout life in response to experience and learning, provides biological justification for the importance of habit

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formation in Islam. The process of memorizing the Qur'an, which is done repetitively and in stages, is not only a spiritual exercise but also a cognitive exercise that literally reshapes neural circuits in the brain, strengthening long-term memory and attention span (Sidah & Suyadi, 2022). Similarly, the meditative state in prayer and dhikr is strongly suspected to involve certain brain activity patterns related to emotional regulation, stress reduction, and increased self-awareness.

Therefore, systematic exploration of the intersection between neuroscience and Islamic Religious Education is highly relevant. This study does not intend to reduce religious experience to mere neural activity but seeks to find mutually reinforcing points of convergence. By understanding the brain mechanisms underlying memorization, concentration in worship, and internalization of faith, Islamic Religious Education teachers can design learning methods that are more in line with the principles of brain function, thereby hopefully increasing the effectiveness of learning and optimally impacting the cognitive and affective aspects of students.

Although the potential for integrating neuroscience and PAI appears promising, there is a wide gap between neuroscience laboratory findings and the PAI classroom. Many teachers and caregivers at tahfiz boarding schools may not yet have been exposed to or have access to relevant neuroscience literature. As a result, the memorization methods applied often rely on strict discipline and mass repetition without considering the principles of working memory, optimal repetition intervals, or the importance of sleep for memory consolidation. In fact, teacher competence and professionalism greatly influence how students can achieve the expected learning outcomes (Mubasysyir & Darmawan, 2024). Moreover, research shows that understanding the memory cycle and the factors that influence retention can significantly improve memorization efficiency (Dweck, 2006). Without an approach informed by neuroscience, the tahfiz process risks becoming more tiring and less optimal than its actual potential.

The second problem lies in the challenge of measuring and facilitating the affective-spiritual aspects of PAI, such as devotion. Devotion is often considered a gift or an inner state that is difficult to teach operationally. Neuroscience, through studies on meditation and mindfulness, has begun to identify the neural correlates of deep focus and emotional regulation. Activity in the prefrontal cortex, reduced activity in the default mode network associated with wandering thoughts, and increased coherence of certain brain waves can be observed. In the learning process, students' attention and motivation are also influenced by the teacher's teaching style and support from the family environment (Safitri & Darmawan, 2023). However, translating these findings into concrete pedagogical guidelines for teachers to train students' concentration in prayer or supplication is still an area that has not been widely explored (Newberg & Waldman, 2009). Teachers need practical guidance, not just theoretical explanations about brain waves.

In addition, there is a risk of simplification or misinterpretation of neuroscience findings. The temptation to engage in "neuro-reductionism", i.e. explaining complex religious experiences solely as brain activity, must be guarded against. This integration must be carried out with a cautious epistemological attitude, where neuroscience serves as a tool for understanding underlying mechanisms, not as a tool for negating the transcendental dimensions and subjective meanings of worship and faith. Character education and religious values remain the main foundation that cannot be replaced by any scientific approach (Al Laisty et al., 2024). The challenge is how to build an equal and productive dialogue between the rich framework of religious knowledge and values and the empirical framework of neuroscience, without one dominating or reducing the other (Oakley, 2004). Without this awareness, integration efforts could actually give rise to new polemics.

This study is important because it attempts to bridge two domains of knowledge that have often run parallel: revelation and science. By reviewing the implications of neuroscience on PAI, we can strengthen the methodological basis of religious teaching with empirical evidence from human brain function. In today's digital age, access to information and technology also influences how students learn and interact with subject matter (Arifin & Darmawan, 2021). This is not to replace the position of revelation as the main source, but to provide additional understanding of how revelation is processed, internalized, and experienced by the human biological apparatus, namely the brain. This approach can provide a more solid foundation for the development of a more effective and humane PAI curriculum and methods, as it is based on an understanding of how the human brain actually learns and develops.

In a situation where the younger generation is exposed to fragmented and instant digital stimulation, an understanding of neuroscience can help design PAI learning strategies that are able to compete and keep pace with these patterns. For example, by

understanding that sustained attention is a limited brain resource, teachers can design memorization sessions with optimal duration and appropriate breaking techniques. Knowing that positive emotions strengthen memory, teachers can create a pleasant and threat-free learning environment. Ultimately, this study is expected to contribute to the realization of religious education that not only transfers knowledge but also shapes character and faith that is deeply ingrained through an approach that is in harmony with human neurobiological nature.

This study aims to conduct a systematic review of neuroscience and Islamic Religious Education literature to analyses the implications of neuroscience findings on three main aspects: Al-Qur'an memorization education, worship concentration, and strengthening of faith. Before drawing conclusions, researchers need to collect and study various relevant sources so that the results of the study can be scientifically accountable (Chada, 2023). The study attempts to synthesize empirical evidence about brain function during religious activities and relate it to pedagogical principles in Islamic Religious Education. Theoretically, this paper is expected to enrich the scientific knowledge of PAI with an interdisciplinary perspective that builds dialogue between science and religion. Practically, the resulting synthesis is expected to serve as a reference for curriculum developers, teachers, and Islamic education practitioners to design more evidence-based, effective learning interventions that are in line with the principles of how the brain works in receiving, processing, and internalizing religious teachings.

RESEARCH METHOD

This study utilizes a qualitative literature review approach. This approach was chosen because it is appropriate for the objective of understanding and interpreting a complex phenomenon, namely the intersection between neuroscience and Islamic Religious Education. Qualitative literature studies allow researchers to explore concepts, theories, and findings from various academic sources in depth, then build a coherent conceptual synthesis without aiming to test hypotheses or produce statistical generalizations (Creswell & Poth, 2018). Through this approach, researchers can delve into the nuances of arguments, identify patterns of relationships between concepts, and formulate new narrative and interpretative understandings of how neuroscience findings can be considered in Islamic Religious Education learning.

The main analysis method applied was thematic synthesis. This method provides a systematic framework for identifying, analyzing, and reporting patterns or themes that emerge from a body of qualitative or conceptual research literature. The thematic synthesis procedure involves three main stages as described by Thomas and Harden (2008). The first stage is the comprehensive coding of texts for substantive findings or discussions from each piece of literature reviewed. The second stage is the grouping of codes that have semantic or conceptual relevance to construct descriptive themes that are still close to the original content of the literature. The third stage is analytical, namely the formation of more abstract themes by integrating and interpreting findings from various studies to answer specific research questions, thereby producing an understanding that goes beyond a descriptive summary.

The application of the thematic synthesis method in this study was carried out iteratively and reflectively. Literature searches were conducted in academic databases such as Google Scholar, PubMed, and ERIC using a combination of keywords: "neuroplasticity AND Quran memorization", "neuroscience of prayer", "brain AND religious belief", "Islamic education AND cognitive science", and "tahfiz neuroscience". The inclusion criteria included publications that directly discussed neuroscience and aspects of education or religious practice, as well as relevant journal articles, books, and dissertations. Each piece of literature was read critically, and sections related to the research question were extracted and coded. The analysis process was carried out by continuously comparing codes and themes between literature to ensure the rigor and depth of the analysis. Bowen's (2009) methodological reference on document analysis as a qualitative research method was used to maintain transparency and accuracy in all stages of the study, so that the resulting synthesis was credible and contributed meaningful knowledge to the development of the field of study.

RESULT AND DISCUSSION

Key Neuroscience Concepts for Understanding and Improving the Methodology of Memorizing the Qur'an (Tahfiz) in Islamic Religious Education

Conceptually, the neuroscience approach provides a scientific basis for understanding how complex cognitive processes such as memorization can be formed in a stable manner. The most fundamental neuroscience concept underlying the process of memorizing the Qur'an is neuroplasticity. Neuroplasticity refers to the brain's extraordinary ability to change its structure and function

throughout life in response to experience, learning and practice. The process of memorizing the Qur'an requires careful attention to hearing and pronunciation, thereby activating the memory consolidation area in the temporal lobe of the brain. Repeated activity contributes to an increase in the capacity of the temporal lobe in learning and memory functions (Gulamhusein & Momanyi, 2020). This principle provides strong biological justification for the practice of tahfiz, which emphasizes repetition and habit formation. When a memorizer (hafiz) consistently repeats verses from the Qur'an, specific neural activity is continuously activated. This repetitive activity strengthens the synaptic connections between neurons involved in storing this information, through a process known as long-term potentiation (LTP). Thus, the neural pathways for accessing memorized information become more established, faster, and more efficient. This process is similar to forming a path that becomes clearer and easier to traverse because it is frequently used. These findings confirm that discipline and consistency in tahfiz are not only religious requirements, but also neurobiological prerequisites for forming permanent memory traces in the brain (Rahman et al., 2011) (Draganski et al., 2004). In other words, the memorizer's brain physically changes and adapts to accommodate the memorization of the Qur'an. Neuroplasticity, in this case, serves as a biological explanation for the effectiveness of repetition, which has long been at the core of the practice of memorization.

From a cognitive perspective, the effectiveness of memorization is also greatly influenced by the natural limitations of the human short-term memory system. The concept of working memory provides a critical perspective for refining the tahfiz methodology. Working memory is a limited-capacity system responsible for temporarily storing and manipulating information. According to Baddeley's model, this capacity can generally only hold around 7±2 units of information for a short period of time. The implication for memorization is clear: overloading working memory with too many new verses at once will cause cognitive overload, preventing information from being processed for long-term storage (Shukri et al., 2020). Therefore, the neuroscience approach recommends chunking and spaced repetition techniques. Rather than memorizing an entire page, a more appropriate method is to divide the material into small, meaningful groups, for example, a few verses per session. This strategy makes optimal use of working memory capacity, allowing the brain to better process and encode information before moving on to the next stage. This principle is in line with classical methods such as murāja'ah (repetition) and tadarruj (gradual progression), but provides a scientific explanation of why these methods are effective (Baddeley, 2020). This understanding encourages tahfiz teachers to design realistic daily memorization targets that are in line with the natural cognitive limitations of their students' brains. Understanding working memory means that setting memorization targets is not merely a matter of discipline, but rather a pedagogical decision based on cognitive capacity.

Understanding working memory means that setting memorization targets is not simply a matter of discipline, but rather a pedagogical decision based on cognitive capacity. The process of memory consolidation bridges working memory and long-term memory, and is the key to successful long-term memorization. Consolidation is the process by which unstable and easily forgotten memories become stable and integrated into existing knowledge networks. Neuroscience has identified that sleep, particularly deep sleep (slow-wave sleep) and REM sleep, plays a central role in this process. During sleep, the brain actively reactivates and strengthens memory traces acquired during waking periods. For a memorizer, this means that sufficient and quality sleep is not wasted time, but an integral part of the memorization session itself. A study by Stickgold (2005) shows that individuals who sleep after learning new information demonstrate significantly better retention compared to those who remain awake during the same period. A conducive learning environment and regular rest patterns also affect the effectiveness of student learning (Haqiqi & Darmawan, 2023). The practical implications are enormous: tahfiz schedules in Islamic boarding schools or schools need to seriously consider the sleep patterns of students. Cramming memorization at night without adequate sleep can be counterproductive, as it hinders the brain's natural consolidation process. Conversely, designing memorization sessions during the day with the guarantee of a good night's sleep will optimize long-term retention. Sleep, in this context, is no longer understood as a passive break, but as an active part of the memorization process.

The timing of repetition also plays a strategic role in maintaining memory stability. The principle of spaced repetition, which originated from memory research, has found strong neuroscientific support (Rahman et al., 2011). Spaced repetition is a technique of reviewing information at increasingly longer intervals. This method has been proven to be

more effective for long-term retention than cramming in one go. Neuroscience explains that every time a memory is retrieved from long-term storage, it becomes unstable for a while before being reconsolidated. This process of retrieval and reconsolidation actually strengthens the memory trace. In education, the use of appropriate learning media and varied methods can also help students remember material longer (Laili & Darmawan, 2024). In tahfiz, this justifies a structured muraja'ah system, in which old memorization is reviewed periodically according to a systematic schedule (e.g. after 1 day, 3 days, 1 week, 1 month). This approach is more effective than focusing only on new memorization and neglecting old memorization until it piles up. Software such as Anki, which uses a spaced repetition algorithm, is a modern application of this principle, which can be adapted to help manage the muraja'ah schedule of memorizers (Cepeda et al., 2006). Digital literacy and the use of technology in learning are important skills that educators and students need to master in the modern era (Rizal & Darmawan, 2024). The integration of such technology can improve the efficiency of memorization management. Structured revision, at this point, gains scientific legitimacy as a strategy for long-term memory maintenance.

Theoretically, memorization can be understood as a process that follows the flow of human information processing. From an information processing theory perspective, the process of memorizing the Qur'an can be mapped into the stages of encoding, storage, and retrieval. Neuroscience enriches our understanding of each stage (Dzulkifli et al., 2014). Optimal encoding requires full attention, which neutrally involves the activation of the prefrontal and parietal networks. This emphasizes the importance of a distraction-free environment when memorizing. Storage involves structural changes in the hippocampus and cortex, which are reinforced by sleep. Smooth retrieval depends on the strength of neural circuits formed through repetition. By mapping the tahfiz process into this framework, educators can diagnose weak points: whether the problem lies in disrupted encoding, poor consolidation due to poor sleep, or infrequent retrieval training. Such a diagnosis allows for more targeted interventions than simply increasing the duration of memorization. This framework helps shift the focus from the mere quantity of memorization to the quality of the underlying cognitive processes.

These theoretical findings have direct consequences for the management of tahfiz institutions. The managerial implications of this synthesis are clear and immediately applicable. First, tahfiz institutions need to revise their curricula and daily schedules to incorporate neuroscience principles. This includes setting daily memorization targets that are appropriate for working memory capacity, inserting short breaks between sessions to prevent cognitive fatigue, and, most importantly, ensuring adequate duration and quality of night-time sleep for all students. Good educational management and effective leadership in educational institutions are essential to create a culture of discipline that supports the learning process (Al Laisty et al., 2024). Second, tahfiz teacher training should be enriched with basic neuroscience literacy modules. Teachers need to understand why certain methods are more effective so that they can explain them to students and apply them with confidence, rather than relying solely on tradition. Third, management can develop or adopt a memorization monitoring system that integrates the principle of spaced repetition, either manually with control cards or with the help of simple digital applications, to manage each student's muraja'ah schedule individually. Teacher professionalism and discipline are also key factors in improving the quality of learning in educational institutions (Mubasysyir & Darmawan, 2024). This approach marks a shift towards more systematic and science-based tahfiz management.

At the evaluation level, neuroscience also opens up new perspectives in assessing the success of tahfiz. At a broader level, this understanding of neuroscience can also change the evaluation paradigm in tahfiz. In addition to evaluating output (the amount memorized), attention needs to be paid to healthy cognitive processes. Chronically forcing the brain beyond its capacity can cause stress, mental fatigue, and even hatred of memorization activities. Conversely, methods that are in line with neuroscience tend to be more sustainable, reduce psychological burdens, and increase students' confidence and success. Thus, this approach not only aims to produce a large amount of memorization, but also to protect mental health and foster a positive relationship between students and the Qur'an in the long term. Among the functions of the Qur'an are as a guide explaining the way of life that distinguishes between right and wrong, a healer of heart disease, advice, and a source of information. As a source of information, the Qur'an teaches humans many things (Nursikin & Nugroho, 2021). Ultimately, the integration of neuroscience into the tahfiz methodology represents an effort to respect and

work with the neurobiological design that Allah has created in humans, using reason to understand how His words can be best embedded in His creation. The neuroscience approach ultimately strengthens the position of tahfiz as a practice of worship that is in harmony with human biological, psychological, and spiritual nature.

Neuroscience Findings on the Regulation of Attention, Awareness, and Meditative States that Can be Implied to Improve the Quality of Concentration and Devotion in the Performance of Worship for Students

Theoretically, devotion in worship can be understood as a psychological capacity rooted in the mechanisms of human attention regulation. Neuroscience findings on attention regulation provide a valuable cognitive map for understanding the challenges of achieving devotion (Rahman et al., 2011). Devotion in worship, such as prayer, essentially requires the ability to maintain sustained attention on a single object, namely communication with Allah, while filtering out distractions from wandering thoughts. Research using functional Magnetic Resonance Imaging (fMRI) shows that the task of maintaining attention involves specific brain networks, particularly the dorsolateral prefrontal cortex (DLPFC) and posterior parietal cortex. Activity in these areas correlates positively with an individual's ability to remain focused. However, another key finding is the identification of the Default Mode Network (DMN), a group of brain regions (including the medial prefrontal cortex and posterior cingulate cortex) that become highly active when the mind is at rest, daydreaming, or remembering the past and future (Buckner et al., 2008). In worship, it is the activation of the DMN that often becomes a source of internal distraction, giving rise to worldly thoughts in the midst of contemplation. This framework places contemplation not as an abstract condition, but as the result of an attention system that can be studied and understood scientifically.

The implications of neuroscience on attention have direct consequences for how worship practices are designed and practiced. These findings about the DMN have direct and profound implications for concentration exercises in worship. Neuroscience also studies consciousness and brain sensitivity in terms of biology, perception, memory, and their relationship to worship (Suyadi, 2022). Based on neuroscience, achieving a state of khusyuk is not just about "trying harder" to focus, but also about actively "calming" the DMN network. Studies on mindfulness meditation, which has strong parallels with the state of khusyuk, show that regular practice can reduce activity and connectivity in the DMN (Munsoor & Munsoor, 2017). This occurs because meditation trains meta-awareness (awareness of awareness), which is the ability to observe the emergence of thoughts without getting involved in them, involving other brain regions such as the anterior insular cortex and anterior cingulate cortex (Brewer et al., 2011). Thus, an approach to increasing reverence can be formulated as a dual exercise: first, strengthening the "attention muscle" through the DLPFC by practicing focus; second, training the "release muscle" to avoid becoming entangled in thoughts arising from the DMN. Dhikr practice using certain methods, such as with feeling (tadharrur) and appreciation of meaning, can serve as a strong anchor for attention, keeping the focus on the dhikr recitation and preventing the mind from wandering to DMN activities. Habitualisation and discipline in worship from an early age are very important for shaping character and good habits in the younger generation (Al Mursyidi & Darmawan, 2023). This approach shows that devotion grows through conscious skills that are trained gradually, not solely through the impetus of intention.

In addition to attention, the dimension of transcendent consciousness also has a neurobiological basis that can be mapped. Neuroscience reveals the neural correlates of altered states of consciousness during deep spiritual practice. Research pioneered by Newberg and colleagues using neuroimaging on meditation and prayer practitioners shows consistent patterns of activity (Bragazzi et al., 2018). They observed increased activity in areas of the brain associated with attention and concentration (such as the prefrontal cortex), while there was a decrease in activity in the superior parietal lobe, the area responsible for processing spatial orientation and self-other boundaries (Newberg et al., 2001). The school environment and family support also play a major role in shaping students' worship habits and concentration (Umroh & Darmawan, 2024). These changes are thought to be the neurobiological basis of transcendent experiences, such as feeling at one with the Almighty or losing awareness of space and time, which are often reported in religious experiences. Although students may not always reach the peak of this experience, understanding that devout worship objectively changes brain activity patterns can provide motivation and a framework for practice. Teachers can explain that devotion is a brain skill that can be trained, and that the neural changes

that occur are in line with the goal of worship to transcend self-interest (ego). This explanation helps bridge the subjective spiritual experience with scientific understanding without diminishing the sacred meaning of worship.

Emotional regulation also plays an important role as the physiological foundation of devotion. Findings on emotional regulation and the autonomic nervous system are also highly relevant. Devout worship is often accompanied by feelings of calm, peace, and surrender. Neuroscience links this state to the activation of the parasympathetic nervous system (responsible for "rest and digest") and a decrease in the activity of the sympathetic nervous system (which regulates the "fight or flight" response). Deep and regular breathing, which is an integral part of prayer and dhikr, is one of the most direct ways to activate the vague nerve and stimulate the parasympathetic response (Mustapha et al., 2016). Research shows that slow, structured breathing can increase heart rate variability, an indicator of resilience and good emotional regulation (Jerath et al., 2015). Therefore, teaching proper breathing techniques as part of prayer preparation, such as inhaling slowly, holding the breath for a moment, and exhaling more slowly, is not an innovation, but rather an evidence-based intervention to calm the nervous system and prepare the physiological foundation for clearer attention and a more devout heart. Learning independence and self-regulation are also important factors in the success of character education (Maharani & Darmawan, 2024). This physiological foundation shows that inner calm is closely related to conscious management of bodily responses.

A state of reverence also has strategic value in affective and spiritual learning. From a learning theory perspective, a meditative or reverent state can be seen as an optimal condition for affective and spiritual learning. Meditation practitioners develop from voluntary control over emotions and subjective preferences towards emotional regulation and impartial awareness of phenomena (Weder, 2022). In this state, because wandering thoughts are reduced and the emotional system is more organized, spiritual messages or moral values conveyed in sermons, advice, or post-worship reflections have greater potential to be internalized. Effective character education requires consistency and exemplary behavior from educators as well as a conducive environment (Aliyah & Masnawati, 2022). The brain is in a receptive and plastic state. Implicitly, the moment immediately after congregational prayer or collective remembrance is a valuable "neuroplastic window" for character education. Teachers or mentors can take advantage of this quiet and calm moment to give brief, meaningful taushiyah (religious advice), guide reflection, or invite students to reflect on a short verse, rather than immediately switching to noisy worldly activities. This strategy takes advantage of the brain's state, which has been "prepared" by worship to receive and reinforce messages of virtue. This approach emphasizes that worship is not only ritualistic but also pedagogical.

These findings demand practical translation at the institutional level. The managerial implications for Islamic educational institutions are highly operational. First, the PAI curriculum needs to include an explicit module on "attention and devotion training". This module could contain simple Islamized mindfulness exercises, such as focusing on the breath while reciting the name of Allah (breath dhikr), or body scan exercises with the intention of giving thanks for the blessing of health. Good educational management and visionary leadership are essential for developing a curriculum that is relevant to the needs of the times (Al Laisty et al., 2024). Second, the physical environment and school schedule must be designed to support the transition to a state of devotion. This means providing a quiet space with minimal visual distractions for prayer or dhikr, as well as allocating sufficient time between the adhan and iqamah, or after prayer, for prayer and reflection. Third, teacher training must include the ability to guide breathing and mind calming exercises, as well as the skills to utilize the post-worship moment to reinforce values. Teacher competence and professionalism are key to improving the quality of learning in educational institutions (Mubasysyir & Darmawan, 2024). This type of management systematically integrates spiritual and cognitive dimensions.

Evaluating the success of devotional practice also requires a more reflective and educational approach. At the evaluation level, a neuroscience-based approach offers a more humane alternative to subjective assessments of "devotion". Progress can be monitored through self-reports on the frequency of wandering thoughts during prayer, the length of time one is able to maintain focus on the meaning of a prayer, or an increase in feelings of calm after worship. Simple wearable technology that measures heart rate variability or breathing patterns can also be an educational tool (not an absolute measuring tool) to provide feedback to learners about their physiological state while practicing devotional prayer. Most importantly, all of these approaches

must be communicated within the framework that this science is a means to be more grateful for and optimize Allah creation, not an attempt to reduce the miracle of worship to mere electrical activity in the brain. Thus, the integration of neuroscience findings on attention and awareness is not only aimed at improving the quality of worship rituals, but also at equipping students with self-regulation and inner awareness skills that will be beneficial for all aspects of their Islamic life. This evaluative approach maintains a balance between educational accountability and respect for the spiritual dimension of worship.

The Brain Mechanism in the Formation of Beliefs and Internalisation of Values can be Utilized to Strengthen the Approach to Teaching Islamic Faith

Conceptually, the formation of beliefs in humans is a multidimensional process involving cognitive, emotional, and existential aspects. Neuroscience's understanding of belief formation and value internalization reveals that this process is far more complex than simply transferring cognitive information. Beliefs, including religious beliefs (creed), are not only stored in a specific part of the brain, but are embedded in a broad associative network that connects semantic memory centers, emotions, and personal experiences. Neuroscience shows that when a person accepts a statement of belief, the brain not only processes its logical meaning, but also simultaneously activates systems related to emotions, values, and self-identity (Ahmad & Suyuthi, 2020). This process involves structures such as the amygdala for emotional responses, the ventral striatum for reward and value processing, and the medial prefrontal cortex for reflection on oneself and others (Harris et al., 2009). The first implication for teaching faith is the need for an approach that consciously integrates cognitive and affective aspects. Presenting naqli and aqli arguments about tawhid, for example, needs to be accompanied by efforts to evoke a sense of awe, dependence, and love for Allah. Without the involvement of positive and personal emotions, information about faith may only become superficial declarative knowledge, rather than a deep-rooted belief that motivates behavior. This framework emphasizes that faith grows through the simultaneous connection of meaning, emotion, and identity.

In human psychological dynamics, the way of thinking plays a central role in determining the strength of a belief. The concepts of automatic thinking versus reflective thinking from cognitive psychology, which have different neural bases, are highly relevant to the strengthening of faith. The automatic thinking system (System 1) operates quickly, intuitively, and is based on patterns and emotions. The reflective thinking system (System 2) operates slowly, logically, and requires mental effort. The challenge of teaching faith often lies in the fact that Islamic teachings are rational and require understanding (System 2), while daily challenges and temptations often arise from quick and emotional impulses (System 1). Neuroscience teaches that in order for a belief to become an automatic guide for life, it needs to be trained in such a way that it can be accessed by System 1. This can be achieved through meaningful repetition and association with emotional experiences. For example, instilling the phrase of tawhid "Laa ilaaha illallah" is not enough just by memorizing its meaning, but it needs to be practiced in various emotional contexts: when happy as a form of gratitude, when sad as a form of surrender, and when facing moral choices as a form of compass. Repeated practice in these different cases helps to "automate" these beliefs at the neural level, making them easier to activate when needed (Kahneman, 2011). This explanation shows that living beliefs are formed through repeated practice that touches on both rational and emotional dimensions.

The method of presenting material has a significant influence on how the brain absorbs and stores beliefs. Findings on the role of narratives and stories in the formation of beliefs have strong methodological implications. The human brain is naturally wired to understand the world through stories. Narratives activate not only the language areas of the brain, but also areas related to sensory and motor experiences (simulation), as well as areas that process emotions and the intentions of others (theory of mind) (Robikah, 2021). When students hear stories about Prophet Ibrahim's steadfastness in seeking God or the Prophet Muhammad's struggle to spread Islam, their brains partially simulate these experiences, creating a more empathetic and profound understanding. Stories are also easier to remember than lists of abstract theological propositions. Therefore, effective teaching of faith must be rich in narrative. The stories in the Qur'an and the Sirah Nabawiyah are not just supplements, but key pedagogical tools that work in harmony with the brain's information processing. Teachers can design lessons around a central story, then draw principles of faith from it, so that abstract principles have a concrete "home" in the narrative memory of students (Gottschall, 2012). This narrative approach

strengthens the adherence to faith through meaningful imaginative experiences.

In addition to narratives, direct experiences play an important role in deepening faith. Neuroscience also explains why direct experiences and real-life practices are crucial for the internalization of religious values (Huda, 2022). The brain learns and forms strong beliefs through multimodal experiences that involve the senses, movement, and emotions. Abstract concepts such as divine justice or God's mercy are easier to understand and believe when students not only listen to lectures but also experience or do them. For example, understanding the concept of gratitude can be deepened through a project of recording daily blessings, which activates reflective processes and positive emotions. Understanding the concept of responsibility (amanah) can be internalized through simulations or real projects at school. Such practical experiences create rich episodic memories, which are more accessible and more strongly linked to the network of values and beliefs in the brain. This approach is consistent with the principle that faith can be increased through righteous deeds; from a neural perspective, consistently performing righteous deeds strengthens the neural networks underlying the beliefs that motivate those deeds, creating a positive reinforcement cycle. This shows that practical application serves as a structural reinforcement for learned beliefs.

In the process of forming beliefs, human cognitive weaknesses must also be taken into account. Understanding the cognitive biases inherent in how the brain works can be used to strengthen religious resilience (Suyadi, 2022). The human brain has inherent biases, such as confirmation bias (seeking information that supports existing beliefs) and attribution bias (blaming others for failures). Intelligent religious teaching can anticipate these biases. Rather than presenting only one-sided arguments, teachers can introduce doubts or common questions that arise in society (within a safe and guided framework), then guide students to examine them using arguments and logic. This kind of dialectical method, which challenges students to actively defend and deepen their beliefs, will actually create a more solid understanding that is resistant to future shocks of thought. The active process of questioning and finding answers involves deeper cognitive elaboration, which strengthens the memory trace for those beliefs. This approach builds resilient faith through conscious intellectual engagement.

Beliefs also do not grow in a vacuum, but in a concrete social context. From a social cognitive theory perspective, beliefs are also formed through social observation and identification. In social interactions, humans need to engage neurons to improve useful and correct communication skills (Huda, 2020). Mirror neurons, which are activated both when we perform an action and when we see others performing the same action, provide the neural basis for learning through observation and empathy (Robikah, 2021). A positive school environment and good school culture greatly influence the development of students' character and beliefs (Dena & Darmawan, 2024). This emphasizes the importance of role models (uswah hasanah) from teachers and the environment. When students see teachers and those around them living consistently in accordance with the beliefs taught, with calmness and happiness, the reward system in their brains can associate Islamic beliefs with positive and desirable outcomes. Conversely, if hypocrisy is apparent, it can create cognitive dissonance and weaken internalization. Therefore, a school environment that consistently reflects Islamic values in daily interactions is a hidden curriculum that is highly influential in the formation of faith. A harmonious social environment is an important medium for the internalization of authentic beliefs.

All of these findings call for planned follow-up in education management. The managerial implications for strengthening the teaching of faith are very clear and require strategic planning. First, the development of the creed curriculum must be based on the principles of cognitive-affective integration and multimodal learning. The syllabus needs to be designed with learning units that combine narrative (stories), logical reflection (discussion of arguments), practical experience (projects or simulations), and emotional exercises (dhikr, muhasabah). Second, the training of religious education teachers must be improved not only in terms of mastery of the material, but also in neuroscience-based pedagogical skills, such as engaging storytelling techniques, facilitating safe critical discussions, and designing learning experiences that involve multiple senses. Third, schools need to create a supportive ecosystem, where religious values are lived out in the school culture, from fair rules to a tradition of gentle mutual advice. The evaluation of faith learning must also evolve, not only measuring the memorization of definitions, but also recording changes in attitudes, participation in value projects, and students' self-reflection on their journey of faith. Educational management that is in line with these principles enables the strengthening

of faith to take place in a sustainable manner.

Ultimately, the neuroscience approach opens up a more holistic perspective on faith education. Utilizing an understanding of brain mechanisms in teaching faith is an effort to respect the complexity of humans as thinking, feeling, and conscious beings. This approach recognizes that strong and living faith is the result of a process that involves the full potential of the brain, not just cold reasoning. By designing teaching that is in line with the way the brain forms beliefs, faith education is no longer merely the transmission of dogma, but becomes a process of sowing and nurturing the seeds of faith in the hearts and minds of students, so that they can grow into trees of conviction with strong roots, impacting their thoughts, feelings, and all their actions in life. Al-Qur'an education and Islamic values that are well integrated are expected to shape excellent personalities and noble character in students (Nuraini et al., 2024). This conclusion emphasizes that the integration of neuroscience and religious education enriches the effort to form a living and resilient faith.

CONCLUSION

Based on a systematic review of neuroscience and Islamic Religious Education literature, it can be concluded that the neuroscience approach offers a strong theoretical and practical foundation for improving Islamic Religious Education methodology. First, the concepts of neuroplasticity, working memory, and memory consolidation provide scientific justification for the basic principles of tahfiz, such as repetition, staggering, and the importance of sleep, while recommending improvements to methods with techniques such as breaking down material and spaced repetition for greater efficiency. Second, findings on attention regulation, Default Mode Network function, and the neural correlates of meditative-devotional states identify that devotion involves dual training to strengthen focus and calm wandering thoughts, which can be facilitated through mindfulness exercises and breathing regulation. Third, understanding the brain mechanisms in belief formation shows that effective internalization of faith requires the integration of narratives, positive emotional experiences, and practical exercises to activate broad cognitive-affective networks and instill values at a deeper and more automatic level.

The findings of this study have profound implications for scientific and educational management practices. Scientifically, this study strengthens the interdisciplinary foundation for the development of PAI learning theory that integrates spiritual dimensions with empirical understanding of brain function. This opens up a new space for dialogue between religious science and neuroscience that enriches each other. At the managerial level, the implications require a transformation in the management of PAI learning. Educational institutions need to revise their curricula, schedules, and evaluation methods, taking into account the principles of neuroscience. This includes developing training modules on concentration in worship, adjusting the tahfiz schedule to accommodate sleep cycles and working memory capacity, and designing faith-based learning based on narratives and experiences. In addition, developing teacher capacity through neuroscience literacy training is a key prerequisite for the proper and effective implementation of these innovations in the classroom.

Based on the analysis, several suggestions for future development are proposed. First, for researchers, further empirical studies are needed to test the effectiveness of PAI learning models that have been designed based on neuroscience principles, as well as research that further explores the neural correlations of specific worship practices in Islam with more rigorous methodologies. Second, for policy makers and managers of Islamic educational institutions, it is recommended to start a gradual integration of neuroscience, beginning with the formation of a curriculum review team, the organization of workshops for teachers, and pilot projects on specific aspects such as tahfiz time management or khusyuk training. Third, for higher education institutions that offer Islamic education teacher training programmed, it is highly recommended to include courses or topics on educational neuroscience and cognitive psychology in the curriculum, so that prospective teachers have the initial knowledge to apply learning approaches that are in line with how the brain works.

REFERENCES

Ahmad, V. I., & Suyuthi, A. (2020). Sholat sebagai Sarana Pelatihan Mindfulness: Jawaban Untuk Tantangan Pendidikan Islam Menghadapi Theage of Complexity. *Akademika*. 13(1), 121-105.

Al Laisty, M. D., Darmawan, D., & Fajar, A. S. M. (2024). The Role of Leadership Style in Building a Discipline Culture in Pesantren: Facing the Challenges of Social and Technological Change. *Bulletin of Science, Technology and Society*, 3(3), 62-68.

Al Mursyidi, B. M. & D. Darmawan. (2023). The

Influence of Academic Success of Islamic Religious Education and Social Media Involvement on Student Morality. *Al-Fikru: Jurnal Ilmiah,* 17(2), 321-331.

Aliyah, N. D., & Masnawati, E. (2022). Implementation of Character Education in Schools: Barriers, Constraints, and the Moral Aspects of the Young Generation. *Journal of Social Science Studies,* 2(1), 119-126.

Arifin, S., & Darmawan, D. (2021). Technology Access and Digital Skills: Bridging the Gaps in Education and Employment Opportunities in the Age of Technology 4.0. *Journal of Social Science Studies,* 1(1), 163-168.

Baddeley, A. (2020). Working Memory. *Memory*, 71-111.

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), 27–40.

Bragazzi, N. L., Khabbache, H., Vecchio, I., Martini, M., Zerbetto, R., & Re, T. S. (2018). Neurotheology of Islam and Higher Consciousness States. *Cosmos and History: The Journal of Natural and Social Philosophy,* 14(2), 315-321.

Brewer, J. A., Worhunsky, P. D., Gray, J. R., Tang, Y. Y., Weber, J., & Kober, H. (2011). Meditation Experience is Associated with Differences in Default Mode Network Activity and Connectivity. In *Proceedings of the National Academy of Sciences*, 108(50), 20254–20259.

Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The Brain's Default Network: Anatomy, Function, and Relevance to Disease. *Annals of the New York Academy of Sciences*, 1124(1), 1–38.

Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed Practice in Verbal Recall Tasks: A Review and Quantitative Synthesis. *Psychological Bulletin*, 132(3), 354–380.

Chada, N. S. (2023). Structured Evaluation in Mentoring Programs for Student Career Development in Higher Education. *Bulletin of Science, Technology and Society,* 2(3), 64–71.

Creswell, J. W., & Poth, C. N. (2018*). Qualitative inquiry and research design: Choosing among five approaches (4th ed.)*. SAGE Publications, London.

Dena, S. & D. Darmawan. (2024). Character Development of Students in Public High School 4 Surabaya Through the Role of School Culture and Parenting Style. *EduInovasi: Journal of Basic Educational Studies,* 4(1), 417–428.

Draganski, B., Gaser, C., Busch, V., Schuierer, G., Bogdahn, U., & May, A. (2004). Neuroplasticity: Changes in Grey Matter Induced by Training. *Nature*, 427(6972), 311–312.

Dweck, C. S. (2006). *Mindset: The New Psychology of Success*. Random House, New York.

Dzulkifli, M. A., Abdul Rahman, A. W., Solihu, A. K. H., Badi, J. A. B., & Afzal, S. (2014, November 1). Optimizing Human Memory: An insight from the Study of Al Huffaz. *International Conference on Information and Communication Technology,* 1-4.

Gottschall, J. (2012). *The Storytelling Animal: How Stories Make Us Human*. Houghton Mifflin Harcourt, New York.

Gulamhusein, T. A., & Momanyi, M. (2020). The Role of Memorizing the Quran in Enhancing the Cognitive Abilities of Students in Bohra Islamic Schools of Karachi, Pakistan. *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 25(12), 52-62.

Haqiqi, M. F. & D. Darmawan. (2023). School Environment and Independence: Effects on Academic Achievement in MTs Nahdlatul Athfal Gersempal Omben Sampang Students. *Kabillah (Journal of Social Community),* 8(2), 171-180.

Harris, S., Kaplan, J. T., Curiel, A., Bookheimer, S. Y., Iacoboni, M., & Cohen, M. S. (2009). The Neural Correlates of Religious and Nonreligious Belief. *PLoS ONE*, 4(10), e7272.

Huda, A. M. (2020). Otak dan Akal dalam Kajian Al-Quran dan Neurosains. *Jurnal Pendidikan Islam Indonesia*, 5(1), 67-79.

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.

Huda, F. I. H., & Widodo, H. A. (2022). Teacher's Efforts in Forming Religious Character in Neuroscience-Based Pai (Islamic Education) Learning. *International Journal of Education Humanities and Social Science*, 5(6), 160-167.

Jerath, R., Crawford, M. W., Barnes, V. A., & Harden, K. (2015). Self-Regulation of Breathing as a Primary Treatment for Anxiety. *Applied Psychophysiology and Biofeedback*, 40(2), 107–115.

Kahneman, D. (2011). Thinking, Fast and Slow. Farrar, Straus and Giroux, New York.

Laili, N. & D. Darmawan. (2024). Investigating the Impact of Educational Media and Teaching Methods on Student Interest at SMP Buana Waru Sidoarjo. *Jurnal Pendidikan Inovatif,* 6(2), 456-471.

Maharani, L. & D. Darmawan. (2024). Factors Affecting Learning Achievement: Learning Discipline and Self-regulation at MTs Wachid

Hasyim Surabaya. *TA'DIBUNA: Jurnal Pendidikan Agama Islam,* 7(1), 12-20.

Mubasysyir, M. M., & Darmawan, D. (2024). Improving Performance: The Role of Teacher Professionalism and Discipline at the Tahsinul Akhlaq Bahrul Ulum Foundation Surabaya. *Hikamatzu | Journal of Multidisciplinary,* 1(1), 337-354.

Munsoor, M. S., & Munsoor, H. S. (2017). Well-Being and the Worshipper: A Scientific Perspective of Selected Contemplative Practices in Islam. *Humanomics*, 33(2), 163-188.

Mustapha, M., Rani, N. S. A., Reza, M. F., Wan Daud, W. N., & Ghani, M. A. A. (2016). Neurotechnological Advances in Exploring Melodic Recitation of the Noble Qur'an: Uncovering the Neural Circuitry in the Human Brain. *In Islamic Perspectives on Science and Technology: Selected Conference Papers*, 229-235.

Newberg, A. B., & Waldman, M. R. (2009). *How God Changes Your Brain: Breakthrough Findings from a Leading Neuroscientist*. Ballantine Books, New York.

Newberg, A., Alavi, A., Baime, M., Pourdehnad, M., Santanna, J., & d'Aquili, E. (2001). The Measurement of Regional Cerebral Blood Flow During the Complex Cognitive Task of Meditation: A Preliminary SPECT Study. *Psychiatry Research: Neuroimaging*, 106(2), 113–122.

Nursikin, M., & Nugroho, M. A. (2021). Internalization of Qur'anic Values in the Islamic Multicultural Education System. *Didaktika Religia*, 9(1), 19-38.

Oakley, K. A. (2004). From Brain to Belief: An Essay on the Neuroscience of Religion. *Zygon*, 39(4), 931-942.

Putra, A. F. M., & Suyadi, S. (2022). The Concept of Neuroscience-Based Inclusive Islamic Education for Millennial Generation: A Literature Review. *Islamic Educational Studies*, 10(1), 41-50.

Rahman, N. N., Adli, D. S. H., Saat, R. M., Hashim, Z. I. M., Bajuri, M. K., & Yusoff, M. Y. Z. (2011). Memorization Activity and Use of Reinforcement in Learning: Content Analysis from Neuroscience and Islamic Perspectives. *Journal of Applied Sciences*, 11(7), 1113-1120.

Rizal, M. I., & Darmawan, D. (2024). Digital Literacy and Utilization of Learning Media: Their Contribution to Academic Achievement in Intensif Taruna Pembangunan High School, Surabaya. *Jurnal Inovasi Pendidikan,* 7(3), 22-30.

Robikah, S. (2021). Metode Brain Based Learning: Mengembangkan Kemampuan Berfkir Siswa dalam Pembelajaran Akidah Akhlak. At-Thullab Jurnal Pendidikan Guru Madrasah Ibtidaiyah, 5(1), 44-56.

Safitri, M. S. & D. Darmawan. (2023). Enhancing Students' Learning Interest: The Role of Teacher's Teaching Style and Parental Support at SD Negeri Wadungasri Waru Sidoarjo. *Jurnal Cahaya Mandalika,* 4(2), 1343-1352.

Shukri, N. H. A., Nasir, M. K. M., & Razak, K. A. (2020). Educational Strategies on Memorizing the Quran: A Review of Literature. *International Journal of Academic Research in Progressive Education and Development*, 9(2), 632-648.

Sidah, S. N., & Suyadi, S. (2022). Pengembangan Hots Berbasis Neurosains dalam Pembelajaran PAI. *Piwulang*, 4(2), 134-146.

Stickgold, R. (2005). Sleep-dependent Memory Consolidation. *Nature*, 437(7063), 1272–1278.

Suyadi. (2022). Learning Taxonomy of Islamic Education. *Millah: Jurnal Studi Agama*, 21(2), 361-410.

Thomas, J., & Harden, A. (2008). Methods for the Thematic Synthesis of Qualitative Research in Systematic Reviews. *BMC medical research methodology*, 8(1), 1-10.

Umroh, U. & D. Darmawan. (2024). The Dynamics of School Environment and the Impact of Parental Attention on the Academic Achievement of Students at SMA Negeri 1 Ketapang Sampang. *Fondatia*, 8(1), 77-87.

Weder, B. J. (2022). Mindfulness in the Focus of The Neurosciences-The Contribution of Neuroimaging to the Understanding of Mindfulness. *Frontiers in Behavioral Neuroscience*, 16, 928522.

Weker, M. (2016). Searching for Neurobiological Foundations of Faith and Religion. *Studia Humana*, 5(4), 57-63.

*Samsiroh, S, N. D. Aliyah, & M. Hariani. (2024). Neuroscience in Islamic Education: A Systematic Review of Implications for Memorization, Devotion, and Faith, *Journal of Social Science Studies* 4(2), 195 – 206.