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The Integration of Prayer and Neuroscience in Islamic Education: A Literature Review on Cognition and Emotional Regulation

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Abstract

Prayer (du'a) represents a central spiritual practice in Islam that extends beyond its theological dimensions to engage psychological and neurological mechanisms relevant to learning readiness, emotional regulation, attention, and cognitive function. This article examines the influence of prayer on cognitive and emotional processes in Islamic education from a neuroscientific perspective through a systematic literature review. Relevant scientific sources pertaining to prayer, spirituality, neuroscience, cognitive processes, emotional regulation, and Islamic education were analyzed using a descriptive-analytical approach. Findings indicate that regularly practiced, mindful prayer has the potential to contribute to psychological calm, stress management, enhanced attention, and cognitive readiness for learning. From a neuroscientific standpoint, emotionally stable conditions create an internal environment that supports attentional function, memory, and information processing. In Islamic education, prayer may be understood not only as an act of worship but also as a practice that strengthens the integration of spiritual, cognitive, and emotional dimensions in learners. The integration of prayer into Islamic education may thus constitute an approach supporting more holistic learning experiences, although causal relationships between prayer practice and changes in brain activity require further empirical investigation.

Keywords: Prayer, neuroscience, Islamic education, cognition, emotional regulation, spirituality.

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INTRODUCTION

Contemporary scholarship in neuroscience and education has increasingly illuminated the biological underpinnings of learning, demonstrating that cognitive performance is inseparable from emotional states, neurological activation patterns, and experiential contexts (Jensen, 2008; Kandel et al., 2013). Within this expanding interdisciplinary landscape, a compelling yet underexplored question concerns the neuroscientific implications of spiritual practices, particularly the practice of prayer in Islamic education. Prayer, known in Arabic as du'a, occupies a foundational position in Islamic life and pedagogy; it is, however, frequently treated as a ceremonial formality rather than a pedagogically meaningful act. A growing body of neuroscientific research suggests that this characterization may be inadequate.

Studies in neurotheology and spiritual neuroscience have demonstrated that practices involving focused attention, repetitive verbal utterance, and mindful intention activate

distinctive patterns of cerebral activity. Beauregard and Paquette (2006) used functional magnetic resonance imaging (fMRI) to show that mystical religious experiences among Carmelite nuns activated the limbic system, the medial orbitofrontal cortex, and the anterior cingulate cortex. Benson and Proctor (1984) identified a physiological relaxation response during prayer and meditation, characterized by decreased heart rate, lowered blood pressure, and parasympathetic nervous system activation. Newberg et al. (2001) demonstrated, through single photon emission computed tomography (SPECT) imaging, that meditation was associated with increased regional cerebral blood flow in the prefrontal cortex, cingulate gyrus, and thalamus — structures linked to attention, emotional regulation, and conscious awareness. Gupta (2015) further noted changes in neural networks, cerebral perfusion, cognitive area activation, and overall subjective well-being as a result of spiritual activity.

Despite this evidence, a significant research gap persists in the Islamic educational context. Most neuroimaging studies of spiritual practice have been conducted with non-Muslim participants, often meditators from Buddhist or Christian traditions (Newberg et al., 2001; Beauregard & Paquette, 2006). Furthermore, while Islamic scholars such as Murtadha Muthahhari and Abdul Majid have emphasized the necessity of integrating spiritual and cognitive dimensions of education, and researchers such as Pasiak (2012) have mapped prefrontal cortex involvement in spiritual activity, there has been limited systematic effort to synthesize neuroscientific findings with Islamic prayer specifically within the context of learning. Existing empirical studies examining du'a in Islamic schools have tended to focus on character formation or religious habit, without probing neurobiological mechanisms (Rosadah & Solihat, 2019; Rusdiono, 2020).

The present article addresses this gap through a systematic literature review. It pursues three interrelated objectives. The first objective is to analyze how prayer practice influences brain function in learners within the educational context. The second objective is to identify the role of neuroscientific approaches in examining the effects of prayer on brain activity relevant to learning. The third objective is to analyze the challenges and limitations inherent in applying neuroscience to the interpretation of prayer as a mechanism for facilitating understanding in Islamic education. By integrating theoretical frameworks from neuroplasticity, the triune brain model, emotional regulation theory, and neurotheology, and by synthesizing empirical findings from neuroimaging and electrophysiological studies, this article argues that prayer in Islamic education warrants recognition not as ritual formality but as a neuropsiritual practice with measurable implications for cognitive readiness, emotional stability, and learning effectiveness.

METHOD

This study employs a library research methodology, defined as a systematic procedure for collecting, analyzing, and synthesizing information from published scholarly sources as the primary basis of inquiry (Zed, 2008). This approach is appropriate for the present study because the object of investigation is conceptual in nature, comprising theories, empirical findings, and interpretive arguments drawn from neuroscience, psychology, Islamic theology, and education rather than from direct empirical observation of participants.

Sources were drawn from two categories. Primary sources included major works from leading neuroscientists such as Andrew Newberg, Norman Doidge, Herbert Benson, Eric Jensen, Eric Kandel, Mario Beauregard, and Antonio Damasio, as well as classical Islamic scholarly texts by Al-Ghazali and Sayyid Quthb, and relevant Quranic verses and prophetic hadith pertaining to the intellect, heart (qalb), and prayer. Secondary sources included peer-reviewed journal articles retrieved from Google Scholar, ResearchGate, and the Directory of Open Access Journals (DOAJ), as well as dissertations, theses, academic reports, and neuroscientific reference works.

Data collection followed a library research protocol involving systematic reading and examination of primary and secondary sources, structured note-taking of key quotations, theoretical positions, and empirical findings, and thematic grouping of data according to three principal domains: the neuroscience of spiritual practice, prayer and brain function, and Islamic educational implications. Data were analyzed through a descriptive-qualitative approach incorporating content analysis to extract meaning from texts and documents, textual criticism to evaluate the authenticity and credibility of sources, and thematic analysis to identify recurring conceptual patterns across neuroscience, spirituality, and pedagogy.

Validity was ensured through source triangulation by comparing and cross-confirming information across multiple literature sources including books, journals, and articles; reference traceability by prioritizing academically verifiable and bibliographically traceable sources; logical consistency analysis to test the coherence and transparency of theoretical arguments; and peer validation through consultation with academic supervisors and subject-area specialists to verify interpretive accuracy.

RESULTS AND DISCUSSION

Neuroscientific Foundations of Brain Function in Learning

Neuroscience, defined as the multidisciplinary scientific study of the nervous system encompassing structural, functional, developmental, and correlational neurobiological analysis of behavior and cognition (Kandel et al., 2013), provides a foundational lens through which the relationship between spiritual practice and cognitive performance can be examined. As Fitriwati Syamsuddin (2021) has described, educational neuroscience specifically investigates how the brain's structure, function, and plasticity respond to learning stimuli — a framework that extends naturally to spiritual stimuli such as prayer.

Two cortical regions are of paramount importance in the context of learning. The prefrontal cortex (PFC), particularly its dorsolateral (dlPFC), ventromedial (vmPFC), and anterior cingulate (ACC) subdivisions, governs executive functions including working memory, planning, impulse control, emotional regulation, and decision-making (Braver et al., 2003; Friedman & Robbins, 2022). The limbic system, comprising the amygdala, hippocampus, and hypothalamus, regulates emotional processing, motivational drives, and the encoding and consolidation of emotionally charged memories (Kandel, 2006; Simic et al., 2021). Critically, the integration of PFC and limbic activity shapes the learner's readiness to attend, process, and retain information. Emotional dysregulation, mediated through amygdalar hyperactivation, has been shown to impair hippocampal and prefrontal

functioning, thereby undermining concentration, memory consolidation, and adaptive thinking (Johnson, 2020).

Neuroplasticity — the capacity of the nervous system to form and modify synaptic connections in response to experience, learning, and environmental stimulation — constitutes the biological mechanism through which repeated spiritual practice, including prayer, may induce lasting changes in brain architecture (Pascual-Leone et al., 2005; Doidge, 2007). Hebbian synaptic strengthening, neurogenesis, and synaptic pruning jointly govern these structural adaptations (Bogdan et al., 2021; Sakai, 2020). The progressive character of neuroplastic change, analogous to the incremental magnetization of iron, suggests that habitual engagement in focused spiritual activity such as prayer may cumulatively reshape the neural pathways underlying attentional control, emotional equilibrium, and cognitive readiness (Doidge, 2007).

Prayer in Islamic Theology and Spiritual Practice

In Arabic linguistic tradition, du'a derives from the root letters د-ع-و, signifying an inherent inclination toward something expressed through voice and language (Anis, as cited in Firdaus, 2018). Lexically, du'a encompasses the meanings of supplication, invocation, appeal, and worship. As a technical theological term, prayer in Islam denotes the sincere address of the servant to Allah, encompassing requests for guidance, assistance, forgiveness, and proximity to the Divine (Al-Khaththabi, as cited in Aziz & Yuliawati, 2022; Ibnu Qayyim, as cited in Firdaus, 2018). Hadith literature establishes the centrality of du'a unequivocally; the Prophet Muhammad (peace be upon him) declared, "Du'a is worship" (HR. al-Tirmidhi, No. 3372), underscoring that supplication is not merely a communicative act but an expression of total reliance upon and submission to Allah.

Classical Islamic scholars have recognized prayer as multidimensional in function. Al-Ghazali conceptualized prayer as a vehicle for self-purification (tazkiyatun nafs), involving the cleansing of the heart and the cultivation of moral character through sustained spiritual discipline (Musrifah, 2020). Sayyid Quthb, interpreting Surah Ar-Ra'd verse 28, argued that the remembrance of Allah produces a state of genuine tranquility (tuma'ninah) that encompasses emotional stability, cognitive clarity, and a sense of existential security — a state that he equated with the optimal internal condition for reflective engagement with reality (Quthb, as cited in the source thesis, 2025). Ibnu Arabi understood prayer as a communicative act with God aimed at purifying the self from any inclination toward associating partners with Allah (shirk), while Ibnu Qayyim characterized du'a as the most powerful spiritual remedy capable of averting, mitigating, or resolving adversity (Firdaus, 2018).

In educational terms, the Quran frequently exhorts believers to expand their intellect, as reflected in verses concluding with phrases such as "afalaa ta'qiluun" (do you not reason) and "afalaa yatadzakkaruun" (do you not take heed), underscoring that intellectual activation is itself a spiritual obligation (Widodo, as cited in the source thesis, 2025). Neuroscientifically significant is the Quranic reference in Surah Al-Alaq, verses 15 to 16, to the "nasiyah" (forelock), which Andrew Newberg has identified as anatomically corresponding to the prefrontal cortex — the seat of moral reasoning and decision-making (Newberg, as cited in

Huda & Suyadi, 2019). Furthermore, the relationship between the nafs described by Al-Ghazali and the limbic system's emotional regulatory functions has been articulated by Us'an and Suyadi (2020), who demonstrated that the spiritual quality of the nafs directly correlates with the functioning of limbic emotional circuitry, providing a neurobiological basis for the classical Islamic claim that spiritual refinement conditions the whole person for virtue and cognition.

Neuroimaging Evidence for the Effects of Spiritual Practice on the Brain

Multiple neuroimaging studies provide convergent evidence that spiritual practices activate and structurally modify regions of the brain critical to learning. Newberg et al. (2001), employing SPECT imaging with eight experienced Tibetan Buddhist meditators, documented significant increases in regional cerebral blood flow during meditation in the cingulate gyrus, dorsolateral prefrontal cortex (DLPFC), inferior orbital frontal cortex, and thalamus. These regions are directly implicated in concentration, emotional regulation, and the governance of conscious awareness. A negative correlation was observed between left DLPFC activity and left superior parietal lobe activity, which the authors interpreted as the neural basis of the altered spatial self-perception commonly reported during deep spiritual states. This finding is particularly germane to Islamic education because the mental state induced by deep prayer, known as khushu (attentive devotion), appears to produce a neurologically analogous condition to that observed in experienced meditators.

Lisa Miller et al. (2019), using fMRI with personalized spiritual imagery, found that spiritual experiences reduced activity in the left inferior parietal lobule — an area associated with self-other differentiation — and also attenuated thalamic and caudate nucleus activity relative to stress conditions. These findings suggest that spiritual experience induces a distinctive neural signature that differs meaningfully from both baseline and stress states, implying that prayer-induced states may uniquely attenuate anxiety-related brain activation while promoting reflective, regulated cognition. Clayton McClintock et al. (2019) similarly observed spiritual experience-specific activation in ventral frontotemporal networks, with activation magnitude correlating positively with the subjective intensity of the spiritual experience, further supporting the claim that prayer engages a measurable, experience-dependent neural substrate.

Structural neuroimaging has extended these functional findings. Lazar et al. (2005) demonstrated through MRI that experienced Insight meditators exhibited significantly greater cortical thickness compared to non-meditating controls, particularly in the right insula, Brodmann areas 9 and 10, somatosensory cortex, and auditory cortex. Crucially, the cortical thickness advantage was most pronounced among older practitioners, suggesting that sustained spiritual practice may serve as a neuroprotective factor against the age-related cortical thinning that typically accompanies diminished cognitive capacity. Kang et al. (2012) confirmed and extended these findings in a study of 46 long-term meditators, identifying increased cortical thickness in anterior frontal and temporal regions including the medial prefrontal cortex, superior frontal cortex, and middle and inferior temporal cortex. Lenhart et al. (2020) further demonstrated that even a seven-week focused attention meditation training

program produced increases in gray matter volume in the insula, caudate nucleus, and frontal cortex, as well as increased axonal integrity in the right hippocampus and basal ganglia — evidence that neuroplastic reorganization can occur even within relatively brief periods of spiritual training. Wintering et al. (as cited in the source thesis, 2025), using fMRI in a study of participants in a one-week intensive spiritual retreat based on St. Ignatius's Spiritual Exercises, documented increased functional connectivity in posterior cingulate cortex, frontal lobe, and cerebellum, alongside positive psychological and spiritual change — evidence that intense spiritual engagement can trigger sustained neuroplastic effects.

Electrophysiological Evidence from EEG Studies

Electroencephalographic (EEG) studies complement neuroimaging evidence by documenting real-time changes in brainwave activity during spiritual practice. Five primary brainwave bands are distinguished in the neuroscientific literature, each associated with distinct cognitive and affective states. Delta waves (0.5 to 3 Hz) predominate during deep sleep. Theta waves (4 to 7 Hz) are associated with meditative states, implicit learning, creative cognition, and the early stages of memory formation. Alpha waves (8 to 12 Hz) characterize a relaxed yet wakeful state conducive to information reception and focused internal attention. Beta waves (13 to 30 Hz) are linked to active cognitive engagement, sustained attention, and information processing, though excessive beta activity correlates with anxiety and cognitive overload. Gamma waves (30 to 100 Hz) support the binding of information across neural networks and are implicated in episodic memory formation (Loonis et al., 2001; Batubara & Supena, 2020).

Doufesh et al. (2016) conducted EEG and electrocardiogram (ECG) analyses during Muslim prayer (salat) and found significant increases in alpha wave activity in parietal and occipital regions, accompanied by elevated parasympathetic nervous system activity and reduced sympathetic tone, together indicating a state of physiological relaxation and mental calm. When comparing complete salat (including verbal recitation and physical movement) to imitative salat (movement only without recitation), the full form produced significantly greater gamma wave activity in frontal and parietal regions, predominantly in the left hemisphere, suggesting that the cognitive content of prayer — rather than physical movement alone — drives enhanced attentional and cognitive neural engagement. Dobrakowski et al. (as cited in the source thesis, 2025) further confirmed that meditation and prayer practice elevate both alpha and theta wave activity, with theta increases being particularly pronounced during experienced meditators' practice compared to relaxation, indicating a deeper neurological engagement specific to contemplative spiritual states. Habibi and Nizmah (as cited in the source thesis, 2025), employing EEG to analyze the effects of listening to salat recitation, found that the dominant occipital alpha frequency increased following exposure to the recitation, indicating that even passive engagement with Islamic prayer-related auditory content induces measurable neural relaxation effects.

Taken together, EEG evidence indicates that prayer — whether active or receptive — systematically shifts the brain toward alpha and theta dominance. This neurological shift has direct implications for learning. Alpha wave states support the filtering of irrelevant sensory

input, facilitating sustained internal focus, while theta activity has been specifically associated with the consolidation of long-term memories and the integration of new information with pre-existing knowledge structures (Loonis et al., 2001; Batubara & Supena, 2020). A learner who enters a study session in an alpha-theta dominant state through prayer is thus neurologically primed for effective information encoding and retention.

Neurochemical Mechanisms of Prayer and Their Educational Significance

Beyond structural and electrophysiological effects, prayer engages specific neurochemical systems whose products directly modulate learning-relevant cognitive processes. Three neurotransmitters are of primary educational significance. Dopamine, released through the brain's reward circuitry involving the ventral tegmental area and nucleus accumbens, is associated with motivation, goal-directed behavior, synaptic strengthening, and the salience attribution that determines what information the brain prioritizes for encoding (Cleveland Clinic, as cited in the source thesis, 2025). When prayer is practiced as an act of sincere intention (ikhlas) oriented toward Allah's pleasure, the learner constructs an intrinsically rewarding motivational framework that may chronically potentiate dopaminergic tone, sustaining academic motivation beyond the immediate study session.

Serotonin governs mood stability, anxiety modulation, and cognitive flexibility, with balanced serotonergic activity creating the mental milieu conducive to sustained attention and adaptive information processing (Shingo Ueda, as cited in the source thesis, 2025). Ueda's research specifically demonstrated that rhythmic-breath prayer increases serotonin release, directly linking prayer practice to the neurochemical substrate of emotional regulation. Endorphins, released during physically and emotionally comforting experiences, reduce the perception of stress and physical discomfort while promoting positive affect — effects that establish a subjective sense of well-being that supports cognitive openness and receptivity to new information (Cleveland Clinic, as cited in the source thesis, 2025). Conversely, prayer-associated attenuation of cortisol — the primary neuroendocrine stress marker — is well-supported in the literature; Sobhani et al. (as cited in the source thesis, 2025) documented that salat practice significantly normalized cortisol levels and influenced stress-related gene expression, while Benson (1984) demonstrated that prayerful practice triggered the relaxation response, reducing circulating stress hormones and their downstream neurological effects. Because elevated cortisol impairs hippocampal neurogenesis and prefrontal executive function (Davidson, as cited in the source thesis, 2025), its attenuation through prayer directly preserves the neural infrastructure most critical to learning.

Prayer as Emotional Regulation in the Educational Context

Gross's (2002) transactional model of emotional regulation identifies two primary regulatory strategies. Cognitive reappraisal, which involves reinterpreting a situation to modify its emotional impact, is generally adaptive, reducing negative emotion without imposing cognitive burden and supporting memory formation and social functioning. Suppression, by contrast, involves inhibiting emotional expression without resolving the underlying affect and tends to impair memory, increase cognitive load, and negatively affect interpersonal

relationships. From a cognitive neuroscientific perspective, prayer in Islam, particularly in the forms of du'a, dhikr, and tawakkul (trust in Allah's plan), constitutes a form of spiritual reappraisal — a process of situating personal difficulty within a framework of divine wisdom and purpose. Parks-Stamm et al. (as cited in the source thesis, 2025) demonstrated that prayer functions as an effective emotional regulation mechanism specifically for managing affective responses to personal problems, supporting the classification of prayer as an adaptive reappraisal strategy.

Tyng et al. (2017) confirmed that emotion affects attention, learning, and memory by enabling selective focus and facilitating information storage, with the amygdala, prefrontal cortex, and hippocampus working in concert to integrate emotional valence with memory encoding. This means that a learner who enters a state of emotional regulation through prayer benefits not only from reduced stress-related neural interference but also from the positive emotional tags that prayer attaches to the learning experience, making academic material more emotionally salient and therefore more durable in long-term memory. The hippocampus, positioned anatomically adjacent to the amygdala and neurally connected to the hypothalamus and attentional association areas, plays a critical role in stabilizing the emotional states that arise from ritual activity, moderating the extreme emotional responses that might otherwise disrupt cognitive processing (Pasiak, as cited in the source thesis, 2025). Interaction between hippocampus and amygdala during prayer thus creates conditions for emotionally enriched yet cognitively stable learning.

Research by Sobhani et al. and Stockigt et al. (as cited in the source thesis, 2025) demonstrated complementary effects of Islamic and Christian forms of rhythmic, repetitive prayer on stress hormone normalization and subjective emotional calm, suggesting that the regulatory effects of prayer are partially attributable to the rhythmic and repetitive structural features of supplication across traditions, though Islamic prayer's content and orientation toward tauhid (monotheism) confer additional theological significance. Menshadi (as cited in the source thesis, 2025) reported that prayer reduces cortisol through sympathetic nervous system down-regulation and parasympathetic activation, creating the precise physiological conditions under which hippocampus-mediated memory consolidation operates most effectively. The direct implication is that students who pray before and during study sessions may exhibit neurophysiologically superior conditions for information retention compared to those who do not.

Prayer as a Neuroplastic Stimulus in Islamic Education

The framework of neuroplasticity offers a unifying theoretical account of how prayer might produce durable cognitive benefits through sustained educational practice. Thompson (2010) argued that spiritual practices including prayer, fasting, and intentional silence drive the brain to form new neural pathways and strengthen existing connections, such that genuine spiritual transformation is necessarily accompanied by biological transformation of the brain through neuroplastic mechanisms. This claim finds empirical support in Wintering et al.'s (as cited in the source thesis, 2025) finding that intensive spiritual engagement produces

measurable fMRI-documented changes in functional connectivity across brain regions mediating emotional regulation, self-awareness, and attentional focus.

In Islamic educational practice, the repetitive recitation of sacred phrases in dhikr, the structured physical and verbal sequences of salat, and the meditative quality of contemplative du'a all constitute forms of focused, repeated neural activation that are precisely the conditions under which long-term potentiation — the synaptic strengthening mechanism underlying memory formation — is most robustly induced (Bogdan et al., 2021; Citri & Malenka, 2008). Prayer's neuroplastic effects thus parallel those of deliberate practice-based learning in cognitive science, with the additional dimension of spiritual meaning potentially enhancing the emotional salience and therefore the encoding strength of associated information.

The neuroplastic potential of prayer is further amplified by its effects on neural connectivity patterns. Vago and Silbersweig (as cited in the source thesis, 2025) demonstrated that mindful contemplative practice shapes three foundational neural capacities: self-awareness, self-regulation, and self-transcendence — each supported by identifiable prefrontal and default mode network circuits. Brewer et al. (as cited in the source thesis, 2025) confirmed that regular meditation reduces default mode network activity, decreasing mind-wandering and strengthening the connectivity between DMN and executive control networks, producing a more present, focused, and purposefully oriented cognitive state. These findings suggest that habitual prayer practice may progressively reshape the learner's default neural architecture toward greater attentional stability, reduced rumination, and enhanced capacity for purposeful engagement with academic material.

Integrative Framework for Prayer-Based Neuroscience in Islamic Education

The convergent findings from neuroimaging, electrophysiology, neurochemistry, emotional regulation research, and neuroplasticity theory collectively support the formulation of an integrative framework for understanding prayer's educational relevance. Conceptually, this framework draws on Amin Abdullah's integration-interconnection paradigm, which proposes that the traditions of prophetic text (hadarat al-nas), scientific inquiry (hadarat al-ilmu), and critical ethics (hadarat al-falsafah) be woven together through a spider-web epistemological model that preserves the normative depth of Islamic sciences while engaging the empirical-rational achievements of modern disciplines (Abdullah, 2006). Within this framework, prayer can be understood as operating simultaneously at three interconnected levels.

At the neurobiological level, prayer activates and structurally modifies the prefrontal cortex and limbic system through repeated neuroplastic stimulation, attenuates stress-hormone systems, elevates serotonin and dopamine release, induces alpha and theta brainwave dominance, and modulates default mode network activity — all changes that optimally condition the brain for learning. At the psychological level, prayer constitutes an adaptive emotional regulation strategy through spiritual reappraisal, providing a framework of divine meaning that modulates the emotional valence of challenges, stabilizes motivational orientations, and strengthens psychological resilience (Howard et al., as cited in the source thesis, 2025; Kor et al., as cited in the source thesis, 2025). At the spiritual-pedagogical level,

prayer enacts the relationship between knowledge, worship, and character that lies at the heart of Islamic educational philosophy, transforming study from a mere information-acquisition exercise into an act of ibadah (worship) oriented toward divine closeness and human flourishing.

A practical pedagogical implementation of this framework may be operationalized through the Conditioning-Centering-Intending (CCI) model proposed in this article. Conditioning involves one to two minutes of regulated diaphragmatic breathing before prayer and study, engaging the parasympathetic nervous system and establishing physiological calm as a baseline for subsequent neural activity. Centering involves the verbal articulation of a focused prayer — for example, "Rabbi zidni 'ilma" (My Lord, increase me in knowledge) or "Allahumma iftah 'alayna hikmataka" (O Allah, open for us Your wisdom) — activating Broca's area and the prefrontal cortex through language-mediated intention-setting and providing a spiritual anchor for the learning session. Intending involves thirty to sixty seconds of silent, aware stillness in the presence of divine consciousness, enabling the transition from externally oriented attention to the internally focused, reflectively receptive mode of neural activity associated with deep learning. Research by Novia Angelina Zuraidy (as cited in the source thesis, 2025) has shown that positive affirmations practiced consistently reduce psychological stress and enhance emotional resilience — effects that converge with the proposed function of prayer-as-affirmation in the CCI model.

Challenges and Limitations of the Neuroscientific Approach to Prayer

Notwithstanding the convergence of evidence reviewed above, significant epistemological and methodological challenges attend the neuroscientific investigation of prayer, particularly within the Islamic educational context. The first and most fundamental challenge concerns the irreducibility of spiritual experience to neural correlates. Neuroscience can map brain activation patterns associated with prayer but cannot, by its own methodological premises, adjudicate whether those patterns constitute, cause, or merely accompany spiritual reality. The transendent dimension of du'a — its orientation toward a living, responsive, all-knowing Allah who grants or withholds in accordance with wisdom — exceeds the reach of empirical instrumentation. A neuroscientific account that reduces prayer to a neurological relaxation technique risks a category error that both misrepresents Islamic theology and truncates the full range of benefits that believers attribute to du'a. This concern parallels the broader critique leveled at neurotheology by Islamic scholars who argue that the biological correlates of religious experience are more accurately understood as divine design embedded within human nature (fitrah) rather than as naturalizing explanations that render the transcendent redundant.

The second challenge concerns the generalizability of existing studies. Most neuroimaging research on spiritual practice has been conducted with non-Muslim meditators, often in individualized laboratory settings that are structurally dissimilar to the communal, institutionalized, and pedagogically embedded contexts in which Islamic educational prayer occurs. The specific content, linguistic form, theological framing, physical postures (raka'at), and communal dimensions of salat and du'a in Islamic practice distinguish them meaningfully

from Buddhist vipassana, Christian centering prayer, and secular mindfulness protocols, meaning that findings from these traditions cannot be uncritically transposed onto Islamic practice. As the thesis notes, detailed specification of prayer type, duration, frequency, and devotional quality are largely absent from existing studies, precluding confident inference about dose-response relationships between prayer practice and neurological outcome.

The third challenge is methodological. The subjective character of spiritual experience renders it difficult to operationalize for experimental control without distorting the phenomenon. Self-report measures of khushu or spiritual depth are inherently vulnerable to social desirability bias, while physiological proxies such as cortisol levels or EEG band power can be confounded by non-spiritual relaxation effects. Quasi-experimental designs employed in some relevant studies — including those examining the effects of dhikr on cognitive performance — face threats to internal validity from inadequate randomization and control variable specification (Anantasia & Rindrayani, 2025). Addressing these limitations will require collaborative research designs developed jointly by neuroscientists and Islamic scholars, employing within-subject crossover protocols that compare neural activity during authentic prayer to structurally matched non-spiritual cognitive tasks, while controlling for prior prayer experience, devotional motivation, and theological understanding.

CONCLUSION

This literature review has synthesized evidence from neuroimaging, electrophysiology, neurochemistry, emotional regulation theory, and neuroplasticity research to construct an integrated account of prayer's potential cognitive and neurological significance in Islamic education. Three principal conclusions emerge from the analysis.

First, the available neuroscientific evidence indicates that prayer and related spiritual practices activate and structurally modify brain regions that are directly instrumental in learning, including the prefrontal cortex, limbic system, anterior cingulate cortex, and hippocampus. These activations are accompanied by neurochemical changes — including elevated serotonin and dopamine, reduced cortisol, and enhanced endorphin release — that collectively constitute a neuropsychological profile conducive to focused attention, emotional regulation, and effective memory consolidation. Electrophysiological data confirm that prayer induces alpha and theta brainwave dominance, placing the brain in a state neurophysiologically optimized for information reception and long-term encoding.

Second, the neuroscientific approach, drawing on neuroplasticity, neurotheology, cognitive neuroscience, and emotional regulation theory, provides a rigorous interdisciplinary framework for examining prayer's role in learning. This approach clarifies the mechanistic relationships between spiritual practice and brain function and affirms the integrative value of iman (faith) and ilmu (knowledge) in Islamic educational tradition. Prayer is not merely a form of devotion appended to academic activity; it is a neurospiritual practice that conditions the biological substrate of cognition, preparing the learner's brain for the reception, processing, and retention of knowledge.

Third, the application of neuroscience to Islamic prayer in educational contexts faces genuine epistemological, methodological, and ethical challenges. The transcendent dimension

of du'a resists full neuroscientific capture; the specificity of Islamic prayer practice has not been adequately addressed in the existing literature; and research designs require substantial methodological strengthening before causal claims can be responsibly advanced. Future empirical research should involve randomized controlled designs conducted within authentic Islamic educational settings, employing real-time neuroimaging and electrophysiological monitoring during actual prayer practice, with participants stratified by devotional depth, theological understanding, and prior prayer experience. Interdisciplinary collaboration between neuroscientists and Islamic scholars is essential to ensure that such research honors both the empirical rigor of modern science and the theological integrity of Islamic spirituality.

The Conditioning-Centering-Intending (CCI) model proposed in this article offers an evidence-informed, pedagogically practical framework for the structured integration of prayer into Islamic educational practice. By positioning prayer as a cognitive-spiritual preparation for learning rather than as a purely ceremonial routine, Islamic educators can harness the convergent evidence of neuroscience and Islamic pedagogy to create learning environments that nurture the intellectual, emotional, and spiritual dimensions of the learner in genuine and measurable integration.

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