



## Beyond Rote Memorization: Reconstructing Quranic Pedagogical Frameworks Through Neurocognitive Learning Principles in Indonesian Islamic Schools

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### Abstract

This article addresses a gap between Islamic educational philosophy and contemporary learning science: the absence of a theoretically grounded framework that reconciles *the hifz* (Quranic memorization) tradition with neurocognitive evidence on deep, durable learning. Quranic memorization has long served as the epistemological foundation of Islamic scholarly transmission in Indonesia and the wider Muslim world. However, its dominant pedagogical form—mechanical repetition-based rote learning—has increasingly been identified as cognitively suboptimal and poorly aligned with how the human brain encodes and retains complex knowledge over time. Existing scholarship tends to take two opposing positions. Some defend memorization through theological arguments without engaging cognitive science, while others critique it through secular constructivist frameworks that overlook the spiritual and epistemic dimensions of Quranic pedagogy. Using qualitative conceptual library research and interdisciplinary thematic synthesis, this article brings Islamic pedagogical traditions into dialogue with neurocognitive learning theories. It focuses particularly on the concepts of *tartil*, *tadabbur*, and *tarbiyah*, and relates them to theories such as cognitive load theory, retrieval practice, spaced repetition, neuroplasticity, and embodied cognition. The analysis yields a novel conceptual model: the Neurocognitive Quranic Pedagogy (NQP) Framework, which proposes a reconstructed pedagogy that preserves the spiritual and epistemic integrity of *hifz* while substantially deepening its cognitive architecture. The article contributes to global debates on religious memorization pedagogy and offers actionable implications for Islamic school curriculum reform, teacher education, and knowledge transmission practices in Indonesia and beyond.

**Keywords:** Quranic pedagogy, *hifz* tradition, neurocognitive learning, Islamic education, cognitive load theory.

## **Introduction**

In the intellectual landscape of Indonesian Islamic education, few practices carry as much normative weight, pedagogical antiquity, and contemporary contestation as the memorization of the Quran. The *hifz* tradition, the systematic memorization of the Quranic text, is not merely a pedagogical method. It is a civilizational practice embedded in Islamic epistemology and grounded in the belief that sacred knowledge must be internalized spiritually and bodily before it is transmitted intellectually. Across Indonesia's more than 26,000 pesantren and madrasah networks, *hifz* remains a foundational curricular pillar. It shapes the educational experiences of millions of students each year (Bayu, 2022). However, the dominant way *hifz* is taught—mechanical and repetitive recitation without systematic attention to meaning, context, or cognitive consolidation—has increasingly become a subject of scholarly debate.

This tension is not peculiar to Indonesia, nor to Islamic education. Globally, debates on memorization-based learning in religious contexts have intensified. Cognitive psychologists and neuroscientists increasingly show that rote repetition alone is insufficient for durable learning. Without semantic elaboration, spaced rehearsal, and retrieval practice, memorization often produces fragile memory traces that decay quickly and transfer poorly across contexts (Brandsford et al., 2000; Roediger & Karpicke, 2006; Sweller, 2011). These findings have galvanized reformist currents within Islamic education scholarship. However, many reform discussions fail to seriously engage with the theological and epistemological roles that memorization plays within Islamic intellectual traditions. Critiques derived from Western constructivist educational theory often treat *hifz* as a pedagogical anomaly that must be replaced. Such critiques rarely consider the possibility that *hifz* may instead be reconstructed and strengthened through insights from neurocognitive learning science.

Two limiting tendencies mark the resulting scholarly landscape. The first is what might be termed apologetic traditionalism: defenses of Quranic memorization that invoke theological authority and historical continuity without adequately engaging with empirical evidence about learning efficacy (Talbani, 1996). The second is secular reductionism: constructivist critiques that evaluate *hifz* against pedagogical criteria derived from entirely different epistemic contexts, thus missing the integral relationship between memorization, spiritual formation, and Islamic knowledge transmission (Sahin, 2018). Between these two positions lies a significant conceptual gap. There is still no integrative framework that treats both the neurocognitive architecture of learning and the spiritual-epistemic logic of Quranic pedagogy as equally important dimensions of educational practice.

This article intervenes in that gap. Specifically, it asks: (1) What is the epistemological logic that underlies *hifz* as a pedagogical practice, and how does it diverge from mechanical rote memorization? (2) What do contemporary neurocognitive learning theories reveal about the cognitive limitations of mechanical memorization practices in Quranic education? (3) What principles could guide the reconstruction of Quranic pedagogy so that it integrates neurocognitive learning science while preserving the spiritual and epistemic integrity of Islamic educational traditions? And (4) what does such a reconstruction imply for curriculum design, teacher training, and knowledge transmission practices in Indonesian Islamic schools?

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Using qualitative conceptual library research and interdisciplinary thematic synthesis, this article proposes the Neurocognitive Quranic Pedagogy (NQP) Framework. This framework does not subordinate Islamic pedagogy to secular learning science, nor does it retreat into theological defensiveness. Instead, it offers an integrative reconstruction of Quranic pedagogy. This article makes three main theoretical contributions. First, it reconceptualizes *hifẓ* as a cognitively complex act of embodied meaning-making rather than mere mnemonic rehearsal. Second, it shows that classical Islamic pedagogical concepts, such as *tartīl*, *tadabbur*, and *tarbiyah*, are structurally aligned with key neurocognitive learning principles. Third, it proposes a new pedagogical model for Indonesian Islamic schools that operationalizes this convergence in curriculum, instruction, and assessment.

### **Literature Review**

#### **Classical and Contemporary Quranic Pedagogy**

The *hifẓ* tradition draws its authority from a foundational Islamic conviction. The Quran is not merely a text to be read, but a living word that must be carried within the human body and transmitted through an unbroken chain of oral–aural reception. The concept of *sanad* refers to the genealogical chain of transmission linking each reciter, through verified intermediaries, to the Prophet Muhammad. This chain is not merely symbolic, it forms the epistemological backbone of Islamic knowledge transmission. Abou El Fadl argues that the Islamic intellectual tradition understands authentic knowledge as requiring both textual content and relational transmission. In classical formulations, a book without a teacher is considered a potential source of error (Fadl, 2001). This principle underlies the institution of the *ijazah*, the formal certification granted by a qualified teacher upon a student's demonstration of mastery, which continues to structure Quranic education across much of the Muslim world.

Classical Islamic pedagogy was far more sophisticated than contemporary portrayals of rote learning suggest. This sophistication can be seen in works such as Ibn Khaldun's *Muqaddimah* and al-Zarnuji's *Ta'lim al-Muta'allim*. Ibn Khaldun, anticipating cognitive load theory by several centuries, warned explicitly against overloading students with simultaneous instruction across multiple disciplines, arguing that the mind requires sequential, consolidated learning to produce genuine intellectual habit. Al-Zarnuji, similarly, emphasized the importance of gradual progression, sustained repetition with comprehension, and the emotional and relational dimensions of learning, which contemporary educational psychologists would recognize as motivational scaffolding and metacognitive awareness (Günther, 2006). These classical formulations reveal an indigenous cognitive pedagogy within the Islamic intellectual tradition. However, this tradition has been insufficiently theorized in contemporary scholarship.

In the Indonesian context, the *pesantren* tradition has historically embodied a distinctive pedagogical model in which *hifẓ* functions as the foundation for subsequent hermeneutic engagement with Islamic texts. The *sorogan* method requires students to present their recitations individually to the teacher. The *bandongan* method involves the teacher reading and

interpreting a text to a group of students. Together, these practices form a multi-modal pedagogical system that combines oral encoding, social learning, and interpretive dialogue (Azra, 2004; Dhofier, 1980). Contemporary scholarship has documented significant diversification within Indonesian Islamic education, with *madrasah* and *pesantren* increasingly integrating national curriculum requirements alongside traditional *ḥifẓ* instruction (Lukens-Bull, 2005). However, this diversification has not been matched by a clear reconceptualization of how Quranic memorization should be taught. The dominant pedagogy remains characterized by extensive repetition, time pressure, and limited systematic attention to cognitive consolidation or meaning-making.

### **Critiques of Rote Memorization in Education**

Critiques of rote memorization have deep roots in Western educational philosophy. Dewey emphasized that education must involve active meaning-making and problem solving. Piaget highlighted the formation of cognitive schemas through experience. Vygotsky later stressed the social nature of learning, particularly the role of language and the zone of proximal development. These theoretical traditions converge on a central claim: that learning which consists of passive reproduction without semantic elaboration, contextual application, or reflective processing produces surface-level retention that is educationally sterile.

Contemporary empirical research in cognitive psychology has substantially supported and refined this critique. Bloom's taxonomy of educational objectives distinguishes knowledge recall from higher-order cognitive processes such as analysis, synthesis, and evaluation. This distinction positions rote memorization as necessary but insufficient for deep learning. Marton and Säljö's (1976) introduced the distinction between surface and deep approaches to learning. Decades of research have confirmed this distinction. Students who rely on surface approaches, such as rote repetition and verbatim reproduction, tend to show weaker conceptual understanding and faster forgetting than those who adopt deep learning strategies involving elaboration, connection-making, and self-explanation (Biggs & Tang, 2011; Entwistle, 2009).

However, the application of these critiques to Islamic religious memorization traditions requires considerable hermeneutic care. Several scholars argue that Western constructivist frameworks embed specific epistemological assumptions. These assumptions concern the relationship between knowledge and experience, the nature of cognition, and the purpose of education. Importantly, they are not culturally or philosophically neutral (Al-Attas, 1979; Sahin, 2018). Constructivism assumes that learning should be anchored in the learner's prior experience and personal meaning-making. This assumption can sit in tension with Islamic educational philosophy, which emphasizes the reception of transcendent knowledge through revelation and the formation of the self according to divine guidance. Dismissing *ḥifẓ* as mere rote learning based on criteria derived from entirely different epistemological contexts risks committing what Al-Attas called the "Westernization of knowledge", the imposition of a particular civilizational framework as a universal cognitive standard.

Cross-cultural research on religious memorization practices has further complicated the picture. Studies of Buddhist scriptural memorization by Shulman (2015), Jewish Torah learning by Halbertal (2007), and Hindu Vedic recitation by Frits Staal (1986) have all

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documented sophisticated cognitive and social architectures within these practices that resist reduction to mechanical repetition. In each tradition, memorization serves simultaneously as a cognitive, social, spiritual, and identity-forming practice. A finding that aligns with recent research suggesting that religious memorization practices may recruit distinct neural networks associated with autobiographical memory, emotional processing, and sense of self (Dam et al., 2018; Kapogiannis et al., 2009).

### **Neurocognitive Learning Principles**

The past three decades have witnessed a dramatic expansion in scientific understanding of how the human brain encodes, consolidates, retrieves, and applies knowledge, a body of research that has profound implications for educational practice in general and for the reconstruction of Quranic pedagogy in particular. Cognitive load theory (CLT), developed by Sweller and elaborated by Paas and colleagues, proposes that working memory, the cognitive workspace in which active information processing occurs, has severe capacity limitations. When learning demands exceed these limitations, cognitive overload results, impairing both immediate comprehension and long-term retention. CLT distinguishes three forms of cognitive load: intrinsic load (inherent to the complexity of the material), extraneous load (arising from poor instructional design), and germane load (productive cognitive effort that supports schema formation). Applied to Quranic pedagogy, CLT suggests that the common practice of requiring students to memorize lengthy passages without prior semantic scaffolding or chunking into manageable units is likely to generate substantial extraneous load, crowding out the germane processing that supports durable memory formation.

The retrieval practice effect is among the most robustly replicated findings in cognitive psychology (Karpicke & Roediger, 2008; Roediger & Karpicke, 2006). Research consistently demonstrates that actively retrieving information from memory produces substantially stronger, more durable memory traces. The mechanisms underlying this effect appear to involve hippocampal reconsolidation each successful retrieval event modifies and strengthens the neural representation of the retrieved information, making future retrieval more efficient (Nader & Hardt, 2009). Critically, retrieval practice produces superior retention even when initial retrieval is effortful and error-prone, a finding with significant implications for the design of Quranic recitation and assessment practices.

Spaced repetition, the principle that distributing practice across time is more effective than massing it in a single session, has similarly received robust empirical support (Cepeda et al., 2006; Kornell & Bjork, 2008). The neurological basis of the spacing effect appears to involve synaptic consolidation processes. When memory traces are reactivated after a period of consolidation, they are not merely retrieved but updated and strengthened in ways that are not possible during massed practice (Smith & Scarf, 2017). The temporal patterns of *hifẓ* practice with daily recitation (*murāja'ah*) of previously memorized material serving as a form of naturally occurring spaced retrieval suggest an intuitive alignment with the spacing principle, though this alignment has rarely been made theoretically explicit.

Research on neuroplasticity, the brain's capacity to modify its structural and functional organization in response to experience, has transformed understanding of what sustained

learning practice accomplishes at the neural level. Studies by Draganski and colleagues and more recently by Zatorre and Salimpoor have documented structural changes in grey matter density associated with intensive rehearsal and musical performance, analogous to what might be expected from sustained Quranic recitation practice (Draganski et al., 2006; Zatorre & Salimpoor, 2013). The embodied cognition perspective, which challenges Cartesian mind-body dualism by arguing that cognitive processes are constitutively shaped by bodily states and actions (Wilson, 2002), offers a particularly compelling lens for understanding the corporeal dimensions of *hifz*, the breath control, postural regulation, articulatory precision, and rhythmic movement involved in proper Quranic recitation, as cognitively functional rather than merely ceremonial.

Elaborative interrogation and self-explanation, techniques in which learners generate reasons for facts or explain their own understanding to themselves, have been shown to substantially enhance deep learning by promoting the integration of new information with existing knowledge structures (Dunlosky et al., 2013). These processes map closely onto the Quranic concept of *tadabbur* (deep reflection on Quranic meaning), suggesting that the Islamic pedagogical tradition itself contains resources for moving beyond surface memorization toward the kind of elaborative processing that cognitive science identifies as foundational to deep learning.

### **Identifying the Conceptual Gap**

Surveying this literature, a substantial and consequential gap becomes apparent. On one side, Islamic education scholarship has extensively documented the practice, history, and theology of *hifz*, but has largely failed to engage systematically with neurocognitive evidence about learning mechanisms. On the other side, learning scientists have generated powerful theoretical frameworks for understanding deep, durable learning, but these frameworks have been developed almost exclusively within secular educational contexts and have rarely been brought into serious dialogue with religious pedagogical traditions. The intermediate space, in which Islamic pedagogical concepts are mapped onto neurocognitive learning principles in a manner that honors both the spiritual-epistemic logic of the former and the empirical rigor of the latter, remains largely uncharted.

A handful of studies have begun to address this gap. Memon examined the pedagogical philosophy of Islamic education through a social constructivist lens, arguing that Islamic pedagogy contains proto-constructivist elements that have been suppressed by mechanical transmission practices (Memon, 2011). Halstead explored the potential for convergence between Islamic values and inclusive, active learning pedagogies (Halstead, 2004). More recently, Aldaghaishi et al., have examined technology-mediated approaches to Quranic learning that implicitly draw on cognitive science principles (Aldaghaishi et al., 2025). However, none of these contributions has produced a theoretically explicit and comprehensive integration of Islamic pedagogical philosophy with the full breadth of contemporary neurocognitive learning science. The present article is positioned as precisely this integrative contribution.

## **Research Method**

This study employs qualitative conceptual library research, a methodology appropriate for theoretical synthesis when the primary objective is not the collection of new empirical data but the critical analysis and reconstruction of existing conceptual frameworks (Leshem & Trafford, 2007; Schwandt, 2015). Conceptual library research proceeds through systematic engagement with the scholarly literature, guided by analytic rather than descriptive reading strategies: rather than summarizing what individual sources say, the researcher identifies conceptual categories, theoretical tensions, and structural correspondences across bodies of literature that have not previously been brought into dialogue.

The literature selection process was guided by three criteria. First, scholarly significance, sources were selected based on their theoretical influence within their respective fields, as evidenced by citation impact, publication in high-ranking peer-reviewed journals, and engagement by subsequent scholarship. Second, interdisciplinary relevance, sources were included only if they contributed substantively to at least one of three thematic domains: Islamic pedagogical traditions, critiques of memorization-based learning, or neurocognitive learning principles, with particular attention to sources that themselves crossed disciplinary boundaries. Third, temporal balance: approximately 75% of sources were published within the past decade (2015–2025), reflecting the rapidly evolving state of both neurocognitive learning science and Islamic education scholarship, while a smaller number of seminal foundational works were included for their irreplaceable theoretical contribution, regardless of publication date.

The analytical strategy proceeded through four stages. In the first stage, thematic indexing, each source was coded according to its primary conceptual contribution, theoretical framework, and relevant empirical or argumentative claims. In the second stage, within-domain synthesis, sources within each of the three literature domains were analyzed comparatively to identify areas of consensus, contested terrain, and theoretical development. In the third stage, cross-domain mapping, conceptual categories from Islamic pedagogical traditions were systematically compared with conceptual categories from neurocognitive learning science, with the explicit objective of identifying structural convergences, productive tensions, and integration possibilities. In the fourth stage, framework construction, the findings of the cross-domain mapping were synthesized into a coherent conceptual model, the Neurocognitive Quranic Pedagogy Framework, whose internal logic was tested against both the requirements of Islamic pedagogical philosophy and the empirical constraints of cognitive learning science.

A critical reflexive dimension was maintained throughout the analysis. The authors were attentive to the risk of conceptual imperialism, the subordination of Islamic pedagogical categories to the framework of Western learning science, and equally attentive to the risk of apologetic over-accommodation, the distortion of neurocognitive evidence to fit predetermined theological conclusions. The analytical strategy was designed to preserve the integrity and distinctiveness of both traditions while actively pursuing productive integrations.

## **Result**

### **The Epistemic Logic of Memorization in Quranic Pedagogy**

The first and arguably most foundational finding of this analysis concerns the epistemological function of memorization within the Islamic intellectual tradition, a function that is frequently misapprehended in both apologetic and critical discourses. Mechanical rote learning and *ḥifẓ* as an Islamic pedagogical tradition are not the same practice. This distinction is not merely terminological but epistemologically fundamental.

In classical Islamic epistemology, *ḥifẓ* refers to a form of comprehensive internalization. This process operates simultaneously across cognitive, affective, embodied, and spiritual dimensions. The classical Arabic term *ḥifẓ* itself encompasses meanings of preservation, protection, and guardianship that exceed mere mnemonic retention. Al-Ghazālī's analysis of 'ilm (knowledge) in the *Iḥyā' 'Ulūm al-Dīn* differentiates between knowledge as information (*ma'lūmāt*) and knowledge as transformative illumination (*nūr*), a distinction that foreshadows the modern science distinction between surface and deep learning. For al-Ghazālī, the purpose of memorizing the Quran is not the accumulation of textual data but the formation of a particular kind of knower: one whose intellect, will, and spiritual orientation are shaped by prolonged, attentive habitation with the divine word.

This epistemological context illuminates why classical Islamic pedagogues invariably coupled memorization with *tartīl* (the measured, melodically regulated, articulatorily precise recitation of the Quranic text), and with *tadabbur* (sustained, interpretive reflection on Quranic meaning). *Tartīl* is not merely a recitation aesthetic but a cognitive-pedagogical strategy: by requiring the precise regulation of breath, tempo, articulation, and melodic contour, *tartīl* creates the conditions for sustained attentional focus and deep phonological processing that prevent the cognitive autopilot associated with mechanical repetition (Nelson, 2001; Rasmussen, 2010). *Tadabbur*, similarly, is not merely a pious aspiration but a pedagogical method: it requires students to return repeatedly to memorized text with questions, associations, and reflective attention that continuously deepen the semantic richness of what has been encoded.

The sanad tradition (the genealogical chain of teachers through whom Quranic recitation is transmitted) also carries a cognitive function that has been largely overlooked in both apologetic and critical discourses. Contemporary research on social and relational learning demonstrates that knowledge acquired within high-trust, personally significant relational contexts is encoded with greater emotional salience and recalled with greater reliability than knowledge acquired in impersonal, transactional settings (Fredricks et al., 2004; Immordino-Yang & Damasio, 2007). The sanad tradition constitutes precisely such a relational learning ecology: it embeds the act of memorization within a web of personal relationships, moral accountability, and community identity that generates the motivational and emotional conditions for sustained deep learning.

### **Cognitive Limitations of Mechanical Memorization in Practice**

Despite the sophisticated epistemological logic underlying the *hifz* tradition as classically conceived, the dominant instantiation of Quranic memorization in contemporary Indonesian Islamic schools frequently diverges significantly from this classical ideal. Empirical studies of *pesantren* and *madrasah* pedagogy document a recurrent pattern: students are required to memorize large quantities of Quranic text within compressed time frames, with assessment focused exclusively on accurate recitation, and with minimal systematic attention to meaning, contextual understanding, or cognitive consolidation (Saepudin et al., 2024; Tanjung et al., 2024; Wijaya, 2024). This pattern corresponds closely to what cognitive psychologists identify as massed rote rehearsal, a strategy that produces short-term recall but poor long-term retention and negligible transfer.

Cognitive load theory provides a precise explanatory framework for understanding why mechanical Quranic memorization frequently fails on its own terms — that is, fails to produce durable, deeply encoded memory — even when teachers and students invest enormous effort. When students are required to memorize Arabic phoneme sequences without adequate semantic scaffolding, the intrinsic cognitive load of processing unfamiliar phonological patterns in a non-native language is compounded by the extraneous load generated by poor instructional sequencing, producing conditions of chronic cognitive overload. Under these conditions, students resort to brittle phonological encoding strategies (verbatim repetition of surface sound patterns) that lack the semantic and contextual structure needed to support long-term consolidation (Mayer, 2021; Sweller et al., 2019).

The neurological evidence is convergent. Research using neuroimaging paradigms has demonstrated that the hippocampal consolidation processes underlying long-term memory formation are substantially more effective when encoded material is semantically rich — that is, connected to meaning, context, and prior knowledge — than when it is encoded as pure phonological sequence (Eichenbaum, 2017; Squire & Dede, 2015). The common *pesantren* practice of prioritizing quantity of memorized text over depth of encoding may thus produce a doubly counterproductive outcome: students who memorize large volumes of text without adequate semantic scaffolding retain less in the long term than students who memorize smaller volumes with deeper contextual engagement.

Furthermore, the social and motivational architecture of mechanical memorization practices frequently works against the relational and emotional conditions that neurocognitive research identifies as conducive to deep learning. Where the classical *hifz* tradition emphasized the personal, trust-based relationship between student and *shaykh* as the relational container for learning, contemporary institutional settings — particularly large *madrasahs* with high student-to-teacher ratios — frequently reduce this relationship to an evaluation dynamic, in which the teacher's role is primarily to verify correct recitation rather than to facilitate understanding and reflection (Lukens-Bull, 2005).

## **Neurocognitive Mechanisms Supporting Meaningful Memorization**

A central finding of this analysis is that when Quranic memorization is understood and practiced in its classical, epistemologically rich form — incorporating *tartīl*, *tadabbur*, and relational transmission — rather than in its reduced, mechanical form, it is structured in ways that are substantially aligned with neurocognitive mechanisms of deep, durable learning. This alignment is not incidental but reflects, we argue, the fact that both classical Islamic pedagogy and contemporary learning science are responding to the same underlying reality: the cognitive and motivational architecture of human learning.

The process of *tartīl* (slow, melodically regulated, articulatorily attentive recitation) engages multiple sensory and motor systems simultaneously: phonological processing, proprioceptive feedback from articulatory movement, auditory monitoring of one's own voice, and the integration of melodic contour with textual structure. This multi-sensory, motor-engaged processing engages what embodied cognition theorists call the motor system's role in linguistic memory (Wilson, 2002). The act of recitation is not merely the vocal output of a mentally stored representation but part of the encoding process itself. Research on embodied memory, including studies of the role of gesture in language acquisition and the motor resonance effects in speech processing, supports the view that corporeal engagement in Quranic recitation is cognitively functional rather than merely ceremonial (Glenberg & Gallese, 2012; Goldin-Meadow, 2005).

The *murāja'ah* practice (the regular, scheduled review of previously memorized material) corresponds with remarkable precision to the optimal spacing schedules identified in experimental research on the spacing effect (Cepeda et al., 2006). Critically, *murāja'ah* is not merely passive re-reading but active retrieval: students are required to reproduce the text from memory, without textual cues, in the presence of a teacher who monitors accuracy. This practice thus constitutes a naturally occurring implementation of what contemporary cognitive psychologists call retrieval practice, the most effective known strategy for building durable long-term memory (Agarwal et al., 2021; Roediger & Butler, 2011).

*Tadabbur*, the contemplative, interpretive engagement with Quranic meaning enjoined throughout the Quran itself (e.g., Q. 4:82; Q. 47:24) and elaborated extensively in classical tafsir and pedagogy, engages precisely the elaborative interrogation and self-explanation processes that cognitive psychology has identified as powerful drivers of deep learning (Chi et al., 1994; Dunlosky et al., 2013). When students are invited to ask why a particular Quranic expression uses a specific grammatical form, how a particular passage relates to their lived experience, or what implications a particular verse carries for ethical conduct, they are engaging in exactly the kind of elaborative processing that produces the richly interconnected semantic networks associated with deep, transferable knowledge.

Finally, the *tarbiyah* dimension of classical Islamic pedagogy, its insistence on the formation of the whole person, integrating intellectual, moral, and spiritual development, aligns with contemporary neurocognitive evidence on the inseparability of cognitive and emotional processing in learning. Immordino-Yang and Damasio's influential argument that emotion is not a distraction from but a constitutive dimension of rational thought and learning is directly

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relevant here. It suggests that the motivational, identity-forming, and emotionally significant dimensions of *hifz* practice are not pedagogically peripheral but cognitively essential to the deep encoding and durable retention of Quranic knowledge (Immordino-Yang & Damasio, 2007).

### **Emerging Principles for Reconstructed Quranic Pedagogy**

Drawing together the three preceding findings, this analysis identifies four emergent principles that can ground a reconstruction of Quranic pedagogy along neurocognitive lines. First, the principle of semantic scaffolding. Quranic memorization should be preceded and accompanied by age-appropriate, systematically scaffolded engagement with the meaning of the text being memorized. This does not require full tafsir scholarship from young students, but it does require that the semantic context (the broad meaning, narrative context, and key vocabulary of a passage) be made accessible before and during the encoding process.

Second, the principle of optimal encoding intervals. The scheduling of *hifz* practice should be explicitly informed by research on spaced repetition, with the intervals between *muraja'ah* sessions calibrated to the spacing schedules that maximize long-term retention. Third, the principle of retrieval primacy. Assessment and practice should prioritize active retrieval (unprompted recitation from memory) over passive re-hearing or re-reading, with retrieval events designed to be productive (testing meaningful content) rather than merely reproductive (verifying verbatim accuracy). Fourth, the principle of embodied elaboration. The corporeal and social dimensions of Quranic recitation (breath regulation, articulatory precision, melodic contour, relational transmission) should be understood and practiced as cognitively functional dimensions of the encoding process, not merely as pious aesthetics.

## **Discussion**

### **Toward A Neurocognitive Quranic Pedagogy**

#### ***Integrating Traditions: An Epistemological Argument***

The theoretical contribution of this article is not merely additive (the application of cognitive science tools to Islamic educational content), but reconstructive. It proposes a reconceptualization of what Quranic memorization is, epistemologically and cognitively, that renders the perceived opposition between tradition and science partly illusory. The opposition has been sustained by a shared misidentification. Both defenders of *hifz* and critics of rote learning have frequently confused the mechanical, surface-level repetition that characterizes much contemporary Quranic memorization instruction with the epistemologically richer *hifz* tradition that classical Islamic pedagogy envisioned and that the Quran itself invites through its repeated injunction to *tadabbur*.

Sahin's concept of "transformative Islamic religious education" is useful here. It argues for a pedagogy that neither abandons Islamic tradition nor petrifies it, but actively reconstructs it in dialogue with contemporary understanding (Sahin, 2018). The present analysis extends this argument by showing that the reconstruction demanded by neurocognitive learning science

is, in important respects, a reconstruction that the classical Islamic tradition itself demands. A recovery of the depth, relationality, and hermeneutic engagement that have been eroded by institutional pressures toward quantitative memorization metrics.

The epistemological implications extend beyond pedagogy to questions of Islamic knowledge formation more broadly. If *hifẓ*, properly practiced, involves not merely phonological encoding but the formation of richly interconnected semantic-spiritual cognitive structures, then the relationship between memorization and understanding (*fahm*) in Islamic education is not sequential (memorize first, understand later) but constitutively intertwined: genuine *hifẓ*, as classical Islamic pedagogy understood it, is already a form of understanding. This reconceptualization has significant implications for how Islamic schools in Indonesia and elsewhere design their curricula, sequence their learning activities, and define the outcomes by which Quranic education is assessed.

### ***Implications for Indonesian Islamic Schools***

Indonesia presents a particularly important and complex context for the reconstruction of Quranic pedagogy. With the world's largest Muslim population, a highly diverse landscape of Islamic educational institutions ranging from elite *pesantren* to community *madrasah* to integrated Islamic schools, and a government that has increasingly sought to modernize Islamic education within a framework of quality assurance and national curriculum standards (Zahra, 2025), Indonesia is at a critical juncture in Islamic educational development. The NQP Framework proposed here speaks directly to this juncture.

At the level of curriculum design, the NQP Framework calls for the integration of semantic scaffolding as a systematic pedagogical component of *hifẓ* instruction across all levels of Islamic schooling. This requires the development of age-graded meaning-engagement materials—vocabulary guides, narrative contextualizations, thematic maps—that accompany memorization units, transforming *hifẓ* curricula from purely phonological programs into integrated comprehension-and-memorization programs. Such materials would not replace existing *hifẓ* curricula but would supplement and deepen them, addressing the extraneous cognitive load generated by phonological-only encoding while increasing the germane load that drives schema formation.

At the level of teacher training, the NQP Framework implies a substantial reconceptualization of what Quranic teachers need to know and be able to do. Currently, teacher certification in Islamic schools focuses primarily on recitation proficiency (tajwid mastery) and textual knowledge, with minimal attention to learning science or pedagogical theory (Tazkirah, 2025). A neurocognitively informed teacher education program would equip Islamic school teachers with knowledge of cognitive load management, retrieval practice design, spaced repetition scheduling, and the facilitation of *tadabbur*-based elaborative reflection, enabling them to function not merely as transmitters of recitation but as pedagogically sophisticated facilitators of deep learning.

At the level of assessment, the NQP Framework calls for a diversification of evaluation beyond quantitative metrics of recitation accuracy. Indonesian Islamic school assessment of *hifẓ* currently centers on the ability to recite assigned surahs without error, a criterion that

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operationalizes a purely phonological conception of memorization. A neurocognitively informed assessment framework would supplement recitation accuracy with assessments of semantic understanding, contextual application, and reflective engagement, thereby creating assessment incentives that reinforce deeper rather than surface encoding strategies.

### ***Preserving Spiritual and Epistemic Integrity***

A critical concern in any reconstruction of Islamic pedagogy from a cognitive science perspective is the risk of reducing sacred practice to cognitive technique, of transforming *hifẓ* from a spiritually formative act into a neurologically optimized information-processing routine. The NQP Framework explicitly resists this reduction. Its argument is not that Quranic memorization should be reconceived as a cognitive technique, but that the spiritual and cognitive dimensions of genuine *hifẓ* are not separable. That the formation of a human being in attentive, reflective, embodied relationship with the divine word is simultaneously a spiritual-formative and cognitive-developmental process, and that neurocognitive learning science illuminates the cognitive architecture of what Islamic spiritual formation has always envisioned.

This argument draws on what might be called the integral anthropology of Islamic education, articulated across the Islamic scholarly tradition from al-Ghazālī to Ibn ‘Ashūr, that the human being is a unified spiritual-cognitive-affective entity, and that genuine education must engage the whole person (Daud, 1989; Halstead, 2004). The NQP Framework's insistence on the motivational, relational, and identity-forming dimensions of *hifẓ* as cognitively functional, rather than merely spiritually decorative, is grounded in precisely this integral anthropology. In this sense, the Framework does not import cognitive science into Islamic education from the outside but discovers that Islamic education, in its most rigorous classical formulations, already possessed a sophisticated implicit cognitive science, which contemporary neurocognitive research can articulate, validate, and extend.

### **The Neurocognitive Quranic Pedagogy (NQP) Framework**

Drawing together the theoretical analysis and findings presented above, this article proposes the Neurocognitive Quranic Pedagogy (NQP) Framework, a conceptual model for reconstructed Quranic pedagogical practice in Indonesian Islamic schools. The NQP Framework is organized around five core principles, each of which represents an integration of a classical Islamic pedagogical concept with a corresponding neurocognitive learning principle.

Principle 1: Purposeful Encoding (*Niyjah*-Informed Cognition): Learning begins with intentional framing. Classical Islamic pedagogy's concept of *niyyah* (intention), which frames every significant act within an ethical-spiritual purpose, corresponds in cognitive function to what contemporary learning science calls goal orientation, that is, the framing of a learning task within a meaningful purpose that activates motivational and attentional resources. Instructionally, this principle implies that *hifẓ* sessions should begin with explicit meaning-engagement. Teachers should introduce the semantic content, narrative context, and spiritual significance of each passage before phonological memorization begins, thereby activating the semantic networks that will support deep encoding.

Principle 2: Structured Rehearsal (*Tartīl*-Aligned Spaced Retrieval): Memorization is distributed and retrieved. The practice of *tartīl* (measured, attentive recitation) should be aligned with empirically optimized spaced repetition schedules, and *murāja'ah* (review) sessions should be structured as active retrieval events rather than passive repetition. Teachers should use interleaving strategies (mixing newly memorized material with previously memorized passages) to strengthen retrieval pathways and resist the interference effects that reduce long-term retention of large memorized corpora.

Principle 3: Semantic Deepening (*Tadabbur*-Driven Elaboration): Memorization is accompanied by reflection. Each *hifẓ* unit should be accompanied by structured *tadabbur* activities, facilitated by the teacher through questioning, discussion, and reflective writing, that engage students in elaborative interrogation of the memorized text. These activities should be designed to connect Quranic content to students' prior knowledge, lived experience, and ethical formation, building the richly interconnected semantic networks that support both deep understanding and long-term retention.

Principle 4: Embodied Practice (Corporeal Encoding): Recitation engages the whole body. The physical dimensions of proper Quranic recitation, covering breath regulation, maqam-based melodic contour, articulatory precision, and postural attentiveness, should be understood and practiced as cognitively functional dimensions of memory encoding, not merely as recitation aesthetics. Teacher training should equip instructors to explain the cognitive function of these embodied practices to students, transforming them from externally imposed requirements into personally understood cognitive strategies.

Principle 5: Relational Transmission (*Sanad*-Based Learning Community): Learning is embedded in relationships. The classical sanad model of transmission, in which knowledge is received within a personally significant, accountable relationship with a qualified teacher, should be preserved and strengthened in institutional design, even within large-scale institutional contexts. Small-group *hifẓ* circles, mentorship structures, and peer recitation partnerships should be institutionalized as the primary pedagogical unit, creating the relational learning ecology that neurocognitive research identifies as essential to the emotional engagement and motivational sustainment required for deep, durable learning.

**Table 1.** The Neurocognitive Quranic Pedagogy (NQP) Framework: Core Dimensions and Integration

Dimension	Classical Islamic Pedagogy	Neurocognitive Learning Science	NQP Integration
Epistemology	Revelation-based; 'ilm as trust	Constructivist; schema formation	Sacred knowledge as neurologically encoded meaning
Memorization Role	Foundation of scholarship; chain of transmission	Retrieval practice: long-term potentiation	Purposeful encoding with semantic anchoring

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Learning Sequence	Tajwid → Hifz → Tafsir	Spaced repetition; interleaving	Encoded recitation → contextual elaboration → transfer
Teacher Role	Shaykh as guide; sanad authority	Scaffolding; metacognitive coaching	Neuro-pedagogical mentor
Assessment	Oral recitation; ijazah	Transfer tasks; elaborative testing	Multi-modal certification with understanding criteria

The NQP Framework is not intended as a prescription for uniform implementation but as a conceptual architecture within which pedagogical adaptation can occur. Indonesian Islamic schools vary enormously in their institutional structures, student demographics, teacher capacity, and community contexts. The Framework's five principles provide a theoretically grounded orientation rather than a scripted program. Implementation research, including design-based studies in pesantren and madrasah contexts, will be essential for translating these conceptual principles into contextually sensitive pedagogical practice.

**Conclusion**

This article has argued that the widely diagnosed failure of Quranic memorization education in Indonesian Islamic schools is not a failure of *hifz* as a pedagogical tradition but a failure of its institutional instantiation. A reduction of an epistemologically rich, cognitively sophisticated, and spiritually formative practice to a mechanical rehearsal routine that violates both the letter of the Islamic pedagogical tradition and the findings of contemporary neurocognitive learning science. Through interdisciplinary conceptual synthesis, the article has demonstrated that the classical Islamic pedagogical concepts of *tartil*, *tadabbur*, *tarbiyah*, and *sanad*-based transmission are structurally convergent with neurocognitive learning principles, including spaced retrieval, elaborative interrogation, embodied cognition, cognitive load management, and relational learning ecology.

The Neurocognitive Quranic Pedagogy (NQP) Framework proposed here constitutes the article's primary theoretical contribution. The integrative conceptual model that operationalizes this convergence rests on five core pedagogical principles. The Framework addresses the epistemological integrity of Islamic educational tradition and the empirical demands of cognitive learning science simultaneously, thereby positioning itself as a genuinely interdisciplinary contribution rather than an application of one framework to the other.

The theoretical contributions of this article extend beyond Indonesia and beyond Quranic education specifically. The analytical approach that is bringing a major religious memorization tradition into critical, mutually respectful dialogue with neurocognitive learning science offers a methodological model for similar interdisciplinary reconstructions in Jewish, Buddhist, Hindu, and other religious educational traditions. The finding that classical Islamic

pedagogy contains implicit cognitive wisdom that neuroscience can articulate and validate challenges the assumption that learning science and religious educational tradition stand in opposition, suggesting instead that the most productive future for both fields lies in precisely the kind of interdisciplinary synthesis this article models.

Several limitations of the present analysis require acknowledgment. As conceptual research, this article does not generate empirical data on learning outcomes, and its findings must be understood as theoretical proposals requiring empirical validation rather than evidence-based prescriptions. The analysis draws on literature from diverse cultural and linguistic contexts and may not adequately capture the full range of local variation within Indonesian Islamic educational practice. The NQP Framework, while grounded in rigorous theoretical synthesis, has not yet been tested in implemented pedagogical programs. Its practical efficacy, cultural reception, and potential unintended consequences remain to be determined through carefully designed implementation research.

Future empirical research should include: classroom-based design experiments implementing NQP principles in pesantren and madrasah contexts; longitudinal studies comparing retention, understanding, and spiritual formation outcomes between NQP-aligned and conventional *hifz* instruction; neuroimaging studies examining the cognitive processes engaged by *tartil* and *tadabbur* practices; and teacher education research examining the professional development processes through which Islamic school teachers acquire and implement neurocognitive pedagogical competencies. Such research would transform the theoretical contribution of this article into an evidence base for practical educational reform, a reform that, if successful, would honor both the deepest aspirations of the Islamic pedagogical tradition and the best current understanding of how human beings learn.

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