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The Neurocognitive Architecture of Qur'anic Memorization: Synthesizing Working Memory and Memory Consolidation Mechanisms

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ABSTRACT

This systematic review synthesizes 13 studies on Qur'anic memorization through cognitive neuroscience. Using PRISMA-guided screening of Scopus and PubMed records, the study identifies three taxonomic clusters: working-memory gating, consolidation-support strategies, and contextual-spiritual modulation. The findings show that Qur'anic memorization depends on attention control, phonological rehearsal, semantic linking, rhythmic repetition, multisensory encoding, muraja'ah-based retrieval, and cognitive load control. The review proposes a Neuro-Tahfidz model that connects sacred verbal input, working-memory regulation, memory consolidation, Islamic learning context, and instructional design. Its novelty lies in translating tahfidz as a theological-practical tradition into an empirical neuroeducational synthesis. It also extends memory theory beyond common Western language stimuli by focusing on a rhymed, repetitive, non-Western sacred text. The model remains conceptual because the reviewed studies use varied designs and limited direct neurocognitive measurements. The synthesis is therefore useful as a theoretical guide, not as a final causal claim. Future research should test the model experimentally across age groups, pesantren settings, and tahfidz learning methods.

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1. INTRODUCTION

Qur'anic memorization, or tahfidz Al-Qur'an, has become a prominent feature of Islamic education in Indonesia. Tahfidz programs are now found in pesantren, formal schools, community-based learning centers, and higher education institutions. This expansion shows that memorizing the Qur'an has moved beyond a traditional religious routine and has become part of wider educational planning. It also creates a practical demand for learning strategies that can help students memorize accurately, retain verses over time, and maintain fluency under regular evaluation (Wafi et al., 2023).

Despite this institutional expansion, many tahfidz practices still rely on conventional repetition-based memorization. Repetition remains important because it trains oral fluency and supports rehearsal. However, repetition alone does not explain why some learners retain memorized verses for long periods while others forget them quickly. Learners often face uneven progress, limited attention span, fatigue, cognitive overload, and difficulty preserving older memorization (Abdullah, 2023). These problems show that tahfidz should not be understood only as frequent recitation. It also needs explanation through cognitive processing, memory stabilization, and instructional design.

This article responds to a theoretical gap in existing memory research. Much research on working memory and memory consolidation uses laboratory tasks, word lists, modern language materials, visual objects, or neutral verbal stimuli (Baddeley, 2012). Qur'anic memorization differs from these stimuli because it involves a rhymed, rhythmically patterned, repetitive, non-Western sacred text. It also carries theological meaning, oral discipline, emotional salience, and social accountability in Islamic learning environments. These features create a distinctive learning context that deserves theoretical synthesis rather than direct borrowing from general memory theory.

Working memory refers to the limited-capacity system that temporarily stores and processes information during learning. In tahfidz, working memory helps learners hold verses in mind, repeat them, monitor pronunciation, manage sequence, and link new material with earlier memorization. Classic memory models explain that information must pass through temporary processing before it can become durable knowledge (Atkinson & Shiffrin, 1968). Later theories refine this view by showing that working memory involves attention control, verbal rehearsal, and integration of multiple sources of information (Cowan, 2001). Working-memory span research further shows that complex span tasks capture the ability to control attention while storing and processing information, which supports the need to consider individual learner capacity in tahfidz instruction (Conway et al., 2005). Developmental evidence also shows that working memory supports learning and educational performance, so tahfidz instruction should consider learner capacity as part of curriculum design (Cowan, 2014).

This interpretation is also supported by executive attention and working-memory span research, which shows that learner capacity influences attention control and complex verbal learning (Alloway & Alloway, 2010). It is also consistent with classic memory and instructional design research on temporary storage, episodic integration, retrieval practice, and cognitive load reduction (Baddeley, 2000). Executive attention theory further clarifies that working memory capacity reflects the ability to maintain goal-relevant information under interference (Engle, 2002).

Cognitive load theory adds an instructional explanation. Learning becomes less effective when the demands of a task exceed working-memory capacity. In tahfidz settings, overload can arise from long verse units, weak pacing, noisy learning environments, insufficient review, or excessive daily targets. Instruction therefore needs to manage intrinsic load from verse complexity, reduce extraneous load from poor design, and strengthen germane load through meaningful rehearsal and retrieval (Sweller et al., 2019). This view supports the need to redesign tahfidz routines as cognitively guided learning sequences. Principles for reducing cognitive load in learning materials also support clear sequencing, concise explanations, and removal of unnecessary distractions (Mayer & Moreno, 2003).

Memory consolidation explains how newly encoded information becomes stable in long-term memory. Consolidation is not a single act of repetition. It involves reactivation, retrieval practice, semantic processing, rhythmic organization, rest, and emotional salience (McGaugh, 2000). In tahfidz education, muraja'ah functions as a practical consolidation strategy because it repeatedly reactivates stored material and protects it from forgetting. This makes muraja'ah not only a devotional discipline, but also a cognitive mechanism of memory stabilization.

The novelty of this study lies in integrating the theological-practical world of tahfidz into a neuroeducational synthesis. Rather than treating Qur'anic memorization only as pedagogy, ritual, or character formation, this study conceptualizes it as an interaction between sacred verbal input, working memory regulation, consolidation mechanisms, spiritual meaning, and cognitive load control. The

synthesis contributes to the emerging paradigm of Islamic Neuro-Education, especially a more specific Neuro-Tahfidz framework.

Based on this gap, the study asks: how do working memory and memory consolidation support the effectiveness of Qur'anic memorization according to relevant scientific literature? The study aims to synthesize findings across selected studies, identify taxonomic clusters, formulate a conceptual framework, discuss contradictory evidence, and clarify the limits of the proposed model's effectiveness.

Table 1. Theoretical Debate Matrix

Theoretical position	Main claim	Relevance to tahfidz	Limitation
Repetition-based pedagogy	Memorization improves through frequent oral repetition.	Explains talaqqi, tikrar, and muraja'ah routines.	Does not fully explain working-memory limits or consolidation quality.
Working memory theory	Learning depends on temporary verbal storage and attention control.	Explains phonological rehearsal, sequence control, and error monitoring.	Needs integration with long-term retention mechanisms.
Memory consolidation theory	Stable retention requires reactivation, semantic links, and time-dependent stabilization.	Explains muraja'ah, rhythm, sleep, and retrieval practice.	Does not fully capture theological motivation and pesantren discipline.
Cognitive load theory	Instruction must manage limited working-memory resources.	Supports chunking, paced memorization, spaced review, and reduced overload.	Requires empirical testing in tahfidz classrooms.
Islamic Neuro-Education	Religious learning can be analyzed through brain, cognition, emotion, and meaning.	Connects sacred text, spiritual motivation, and neurocognitive processing.	Still needs direct neurocognitive measurement and longitudinal validation.

2. METHODS

This study used a Systematic Literature Review (SLR) method to examine working memory and memory consolidation in Qur'anic memorization. The SLR method enables transparent identification, evaluation, and synthesis of relevant literature. It also helps reduce subjective bias in selecting and interpreting studies (Snyder, 2019). The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to guide identification, screening, eligibility assessment, and inclusion (Page et al., 2021).

The literature search was conducted from 10 to 15 May 2025 using Scopus and PubMed. Harzing's Publish or Perish was used to support retrieval and bibliographic management. The Scopus search string was: TITLE-ABS-KEY(("working memory" OR "short-term memory" OR "cognitive load") AND ("memory consolidation" OR "long-term memory" OR retention OR retrieval) AND ("Qur'an memorization" OR "Quran memorization" OR tahfidz OR tahfiz OR "Al-Quran")). The PubMed search string was: (("working memory" OR "short-term memory" OR "cognitive load") AND ("memory consolidation" OR "long-term memory" OR retention OR retrieval) AND ("Quran" OR "Qur'an" OR tahfidz OR tahfiz)). Indonesian equivalents, including neurosains, memori kerja, konsolidasi memori, and tahfidzul Qur'an, were also used for additional checking.

Articles were included if they were peer-reviewed, written in Indonesian or English, published between 2015 and 2025, and discussed neuroscience, working memory, memory consolidation,

memorization, or Qur'anic learning. Articles were excluded if they were not peer-reviewed, published before 2015, unavailable in full text, written outside Indonesian or English, or unrelated to the review focus. Foundational theoretical sources published before 2015 were used only to strengthen conceptual explanation and were not counted as part of the 13 main studies.

Quality and risk of bias were assessed through five criteria: clarity of research objectives, appropriateness of method, relevance to the review question, transparency of data or source selection, and strength of conclusions. Each article was rated as low, moderate, or high risk. Articles with unclear methods, weak relevance, or unsupported conclusions were excluded or used only with caution during synthesis. This quality check was necessary because the reviewed studies included experimental research, conceptual studies, scoping reviews, and qualitative analyses.

Table 2. Inclusion and Exclusion Criteria

Aspect	Inclusion criteria	Exclusion criteria
Publication year	Published between 2015 and 2025	Published before 2015
Document type	Peer-reviewed journal articles	Non-peer-reviewed articles, opinions, essays, or non-scientific reports
Journal quality	Indexed in Scopus, PubMed, or at least SINTA 3 for Indonesian journals	Journals not indexed in Scopus, PubMed, or below SINTA 3 for Indonesian journals
Language	Written in Indonesian or English	Written in languages other than Indonesian or English
Study context	Related to neuroscience, working memory, memory consolidation, memorization, or Qur'anic learning	Not related to neuroscience, working memory, memory consolidation, memorization, or Qur'anic learning
Methodology	Empirical studies, literature reviews, or theoretical studies with clear scientific methods	Articles without clear methodology or only speculative discussion

Table 3. PICOC Framework

Component	Description
Population	Students who memorize the Qur'an
Intervention	Learning approaches based on working memory and memory consolidation
Comparison	Conventional or traditional approaches based mainly on verbal repetition
Outcome	Improved effectiveness of tahfidz learning
Context	Islamic education, especially tahfidz institutions and pesantren

Table 4. Quality and Risk of Bias Assessment Summary

Assessment domain	Operational criterion	Decision rule
Objective clarity	The study states a clear aim and research focus.	Unclear aims increased risk of bias.
Method appropriateness	The method fits the objective and data type.	Mismatch between aim and method increased risk.
Relevance	The study discusses memory, cognition, tahfidz, Qur'anic reading, or learning.	Low relevance led to exclusion.
Transparency	The article explains sample, corpus, procedure, or review process.	Limited transparency was coded as moderate risk.
Conclusion strength	Claims are supported by data or literature.	Speculative conclusions were treated with caution.

The initial search identified 2,398 records, consisting of 600 from Scopus and 1,798 from PubMed. During identification, 2,100 records were removed because they were duplicates, marked as ineligible, unavailable in full text, or unrelated to the domain. After this stage, 298 records remained for title and abstract screening. A total of 170 records were excluded because they did not directly address the topic. The remaining 128 full-text articles were assessed for eligibility. At this stage, 115 articles were excluded because 45 did not meet inclusion criteria, 40 were not peer-reviewed, and 30 did not focus on working memory, memory consolidation, or tahfidz learning. Finally, 13 articles met all criteria and were included in the systematic review.

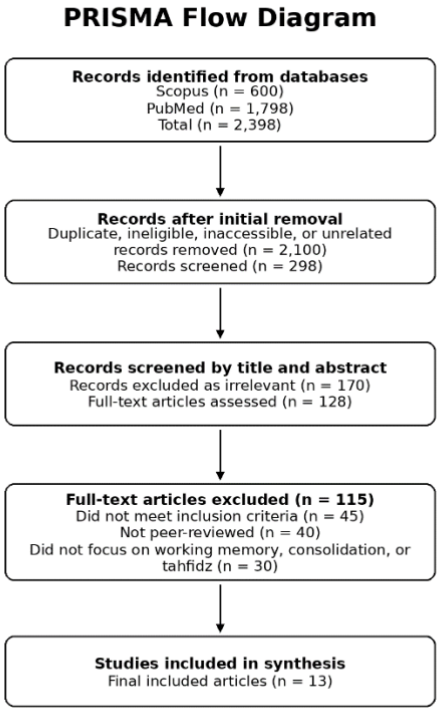

Figure 1. PRISMA Flow Diagram of the Study Selection Process

The selected articles were analyzed using thematic analysis. Extracted information included author, year, research focus, method, finding, relevance, theoretical contribution, and risk of bias.

Thematic synthesis produced three taxonomic clusters: working-memory gating, consolidation-support strategies, and contextual-spiritual modulation.

3. FINDINGS AND DISCUSSION

The review identified 13 eligible studies. The synthesis produced three taxonomic clusters. The first cluster, working-memory gating, explains how attention control, phonological rehearsal, and sequencing support initial memorization. The second cluster, consolidation-support strategies, explains how muraja'ah, rhythm, semantic understanding, multisensory learning, and retrieval practice stabilize memorized verses. The third cluster, contextual-spiritual modulation, explains how religious meaning, motivation, and pesantren routines shape persistence and review behavior.

These clusters do not operate separately. They form an integrated architecture. Sacred verbal input enters the learner's cognitive system through attention and auditory-verbal rehearsal. Repeated review then stabilizes the input through consolidation. The Islamic learning environment regulates motivation, discipline, and emotional meaning. This integrated view allows tahfidz learning to be discussed as both a religious practice and a neuroeducational process.

3.1. Taxonomic Clusters of the Reviewed Studies

Table 5. Taxonomic Clusters Extracted from the 13 Articles

Cluster	Core mechanism	Studies represented	Main synthesis
Working-memory gating	Attention control, phonological rehearsal, temporary sequencing	(Bahmani et al., 2019)	Tahfidz begins with controlled verbal processing. Learners need focused attention, auditory-verbal repetition, and manageable verse units.
Consolidation-support strategies	Muraja'ah, rhythm, semantic links, multisensory cues, retrieval practice	(Aziz et al., 2024)	Long-term retention depends on repeated retrieval, meaning formation, rhythmic organization, and structured review.
Contextual-spiritual modulation	Motivation, sacred meaning, pesantren discipline, emotional engagement	(Abdullah, 2023)	The sacred status of the text and institutional routines shape effort, persistence, and consistency.

The first cluster places working memory as the entry point of tahfidz learning. It aligns with the multicomponent model of working memory, which identifies the phonological loop, central executive, visuospatial sketchpad, and episodic buffer as core components of temporary information processing (Baddeley, 2012). This cluster is important because Qur'anic memorization requires oral repetition, auditory monitoring, sequential order, and short-term retention before long-term storage becomes possible.

The second cluster places consolidation as the stabilizer of memorized verses. The reviewed studies show that muraja'ah, rhythm, semantic linking, and multisensory learning support retention. This cluster is consistent with consolidation theory, which explains that memory traces need

reactivation and time-dependent stabilization before they become durable (Dudai, 2004). It is also compatible with retrieval-based learning research, which shows that active recall strengthens later retention more effectively than passive restudy (Roediger & Karpicke, 2006).

The third cluster highlights the Islamic learning context. Tahfidz is not performed in a neutral laboratory setting. It is shaped by adab, teacher authority, spiritual intention, group discipline, and repeated institutional routines. This means that memory processes are not separated from value formation and learning culture. The cognitive process is strengthened by motivation and meaning, while the religious context gives learners reasons to repeat, review, and preserve memorization.

3.2. Working Memory as the Entry Gate of Tahfidz Learning

Working memory operates as the first gate of Qur'anic memorization. It allows learners to hold verses temporarily, repeat them orally, monitor errors, maintain order, and connect new verses with previous memorization. The phonological loop is central because tahfidz is strongly audio-verbal. The central executive supports attention control, while the episodic buffer helps integrate sound, meaning, and sequence (Baddeley, 2012). The comparison between multicomponent and embedded-processes models also supports the view that working memory involves both temporary storage and active attentional control (Ozimič, 2020).

The role of attention is especially important. Prefrontal mechanisms support attention and working memory by maintaining task-relevant information and suppressing interference (Bahmani et al., 2019). D'Esposito and Postle (2015) also argue that working memory depends on neural systems that maintain goal-relevant information. In tahfidz, these systems help learners preserve pronunciation, sequence, and fluency under repetitive practice.

Working-memory capacity also explains individual differences in tahfidz progress. Learners with stronger attention control may process longer verse units with fewer errors. Learners with weaker attention control may need shorter chunks, more auditory modeling, and more frequent review. This interpretation is consistent with broader working-memory research showing that capacity is closely related to controlled attention and task performance (Unsworth & Engle, 2007).

However, the evidence is not fully uniform. Hasim et al. (2023) reviewed broad benefits of reciting, listening to, and memorizing the Qur'an, but their scoping design does not prove that Qur'anic recitation directly improves short-term memory in all learners. Slamet (2019) and Sriyanto et al. (2023) suggest cognitive benefits among children, but their designs do not isolate memorization from family support, schooling quality, prior Arabic exposure, or religious environment. These contradictions show that the working-memory claim is plausible but still needs stronger experimental testing.

The implication is clear. Tahfidz instruction should not treat all students as having the same cognitive capacity. Teachers need to adjust verse length, repetition cycles, and error correction to learners' working-memory limits. Cognitive load theory supports this adjustment because it treats working memory as a limited instructional resource (Paas et al., 2003).

3.3. Memory Consolidation as the Stabilizer of Long-Term Retention

Memory consolidation stabilizes memorized verses after initial encoding. In tahfidz, consolidation is supported by muraja'ah, retrieval practice, rhythm, semantic understanding, multisensory learning, and planned review. McGaugh (2000) explains that consolidation is a time-dependent process that transforms fragile memory traces into more stable forms. This mechanism explains why memorization without review often becomes weak. Systems-level consolidation research also explains that long-term memory stabilization can involve gradual reorganization across memory systems (Squire & Alvarez, 1995).

Sleep and rest may also matter. Consolidation research shows that sleep contributes to the reorganization and stabilization of memory traces (Diekelmann & Born, 2010). Rasch and Born (2013) further explain that sleep supports memory through system-level and synaptic processes. In tahfidz

education, this insight suggests that heavy memorization schedules should consider fatigue, rest, and review timing, not only daily memorization targets. Sleep-related plasticity research further supports the idea that rest can strengthen learning after initial encoding (Walker & Stickgold, 2006).

Retrieval practice is another important mechanism. Roediger and Karpicke (2006) showed that testing or active recall can improve long-term retention. Karpicke and Roediger (2008) also found that repeated retrieval produces strong learning benefits. Karpicke and Blunt (2011) add that retrieval practice can produce stronger meaningful learning than elaborative restudy. Muraja'ah resembles retrieval practice because learners actively recall memorized verses, detect errors, and restabilize memory traces. This gives a scientific explanation for why muraja'ah is central in tahfidz routines.

Ridwan and Arifa (2024) show that muraja'ah in prayer can improve memorization quality. Aziz et al. (2024) show that rhythmic learning improves accuracy, fluency, and retention. Faqihuddin et al. (2024) show that multisensory strategies can improve memory and attention in early childhood. Muslim et al. (2024) add that memory tendencies and semantic processing matter in Qur'anic memorization. Together, these findings show that consolidation in tahfidz is not only repetition. It also depends on organized retrieval, meaning, rhythm, and sensory engagement. Studies of tahfidz and translation patterns also show that structured memorization routines can shape retention and learning effectiveness (Suryana et al., 2024).

Some findings remain indirect. Munawaroh et al. (2023) and Tobing et al. (2022) examine Qur'anic reading among older adults, not tahfidz learners. Their findings support the broader cognitive benefits of Qur'anic activity, but they cannot fully prove the effectiveness of memorization strategies among children or pesantren students. This limitation requires careful interpretation of the proposed model.

3.4. The Neuro-Tahfidz Conceptual Framework

Qur'anic memorization has distinctive verbal features. It includes rhythm, rhyme, phonological patterns, and repeated recitation. Research on music and speech suggests that rhythm can organize auditory information and support temporal prediction (Zatorre et al., 2007). Patel (2003) also shows that language and music share structural processing resources. In tahfidz, rhythm may serve as a cue that helps learners predict sequence and recover verses during recitation.

Semantic meaning adds another layer. Dual coding theory explains that information becomes stronger when verbal material connects with nonverbal or meaningful representations (Paivio, 1991). In Qur'anic memorization, understanding the meaning of verses may help learners build semantic links beyond sound patterns. Muslim et al. (2024) support this point by showing that memory system tendencies and meaning-based processing matter in memorization. The levels-of-processing framework also explains why deeper semantic processing can support stronger memory than surface repetition alone (Craik & Lockhart, 1972).

Chunking also matters. Human learners often process complex material by grouping information into meaningful units. Gobet et al. (2001) explain chunking as a core mechanism in cognition. In tahfidz, chunking can take the form of dividing verses by phrase, theme, rhythm, waqf sign, or meaning unit. This practice reduces overload and helps the learner move from temporary processing to stable retention. Long-term working memory theory also explains how experts use structured knowledge to handle complex information more efficiently (Ericsson & Kintsch, 1995).

These theoretical points support the review's novelty. Most memory studies examine neutral or modern language materials. Qur'anic memorization adds sacred meaning, rhythmic structure, repeated oral transmission, and community-based accountability. This makes it a strong case for expanding memory theory into non-Western religious learning contexts.

3.5. Contradictory Results and Boundary Conditions

The reviewed studies do not provide a single uniform conclusion. Several studies report cognitive benefits of Qur'anic recitation, reading, or memorization. However, the methods vary widely. Some

use quasi-experimental designs, some use qualitative approaches, and others use scoping or literature reviews. This diversity strengthens thematic coverage but weakens causal certainty.

One contradiction concerns the object of learning. Studies on Qur'anic reading among older adults support the cognitive benefits of Qur'anic activity, but they are not identical to tahfidz studies. Reading, listening, and memorization share verbal processing, yet each uses different cognitive demands. Reading may support attention and fluency. Memorization requires stronger encoding, retrieval, and sequence control. Therefore, evidence from Qur'anic reading should be used as supportive, not definitive, evidence for tahfidz.

Another contradiction concerns age and context. Early childhood studies emphasize multisensory support and movement-based learning, while pesantren studies often emphasize discipline, repetition, and muraja'ah. Adult and elderly studies often focus on cognitive maintenance. These different populations suggest that the Neuro-Tahfidz model should be adapted by age, prior Arabic knowledge, motivation, and institutional routine.

A further boundary concerns measurement. Few studies directly measure working-memory capacity, cognitive load, or neural activity. Most studies infer cognitive mechanisms from learning outcomes. This means the proposed model is theoretically strong but empirically incomplete. It should be treated as a synthesis for future testing, not as a confirmed causal pathway.

3.6. The Neuro-Tahfidz Conceptual Framework

Based on the synthesis, this study proposes a Neuro-Tahfidz conceptual framework. The model begins with Qur'anic verses as sacred, rhymed, and repetitive verbal input. This input enters working memory through attention and phonological rehearsal. It then moves toward consolidation through muraja'ah, semantic linking, rhythm, multisensory cues, and rest. Cognitive load control functions across the whole process by dividing material into manageable units, reducing unnecessary distractions, and increasing meaningful processing. The Islamic learning context shapes motivation, persistence, and review discipline.

The model also suggests a reciprocal pathway. Long-term retention is not only the final output. It also provides feedback to instructional design. When students show weak fluency or frequent errors, teachers can adjust chunking, review intervals, auditory modeling, and semantic support. This feedback loop makes Neuro-Tahfidz a dynamic instructional model rather than a linear memorization sequence.

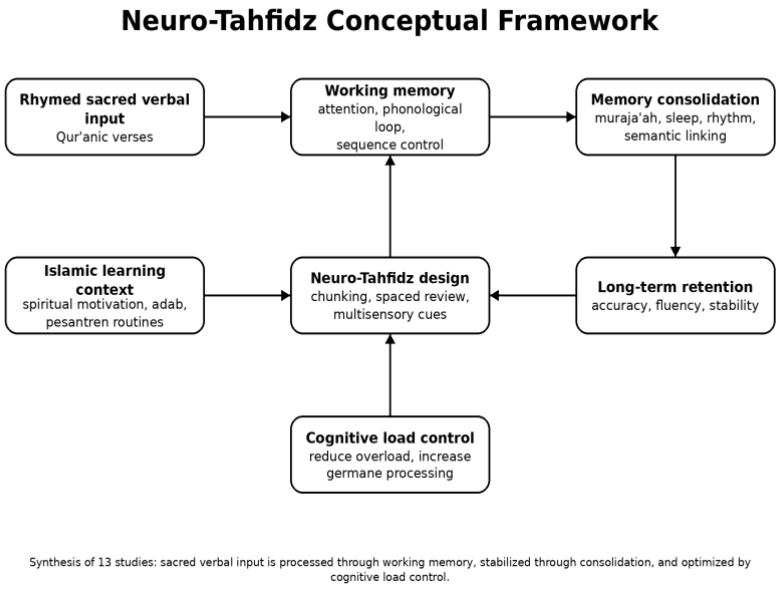

Figure 2. Neuro-Tahfidz Conceptual Framework

3.7. Implications for Scientific Development

The findings support the development of Islamic Neuro-Education as a broader paradigm and Neuro-Tahfidz as a specific model for Qur'anic memorization. This paradigm does not reduce sacred learning to brain mechanisms. Instead, it connects religious practice with empirical learning theory so that tahfidz instruction can become more evidence-based while remaining rooted in Islamic educational values. Research connecting neuroscience with Qur'anic memorization methods also supports the need to examine hafazan strategies through cognitive and educational perspectives (Tahir et al., 2024).

Cognitive load theory can redefine standards in traditional Islamic boarding school curricula. Instead of measuring progress only by the number of new verses memorized each day, pesantren curricula can also consider verse complexity, student attention span, review intervals, error patterns, and fatigue. This approach supports chunked memorization, spaced muraja'ah, interleaved review, and multisensory scaffolding. It also helps teachers avoid excessive daily targets that may overload working memory and weaken long-term retention.

Spaced review has strong support in learning research. Cepeda et al. (2006) show that spacing produces durable retention across many learning contexts. Dunlosky et al. (2013) also identify practice testing and distributed practice as high-utility learning techniques. These findings support a tahfidz curriculum that balances new memorization with systematic muraja'ah. The curriculum should not reward speed alone. It should also reward retention stability, error reduction, and accurate retrieval.

Neuro-Tahfidz also encourages a more precise language for evaluation. Instead of saying that a learner is weak in memorization, teachers can identify whether the problem lies in attention control, phonological rehearsal, semantic linking, consolidation interval, or review discipline. This diagnostic language may help teachers design interventions that are more specific and fair.

The effectiveness of the proposed model has limits. It should not be treated as a universal solution for all tahfidz learners. Age, prior Arabic knowledge, sleep quality, motivation, teacher feedback, and institutional routine may influence outcomes. The model is also based on synthesis rather than direct brain measurement. Future research should use experimental designs, longitudinal retention tests, cognitive load measures, and neurocognitive instruments to validate the model.

Table 6. Neuro-Tahfidz Mechanisms and Instructional Applications

Mechanism	Instructional application	Expected contribution
Attention control	Short, focused memorization sessions; low-distraction setting	Learners maintain pronunciation and sequence more accurately.
Phonological rehearsal	Talaqqi, auditory modeling, controlled repetition	Learners strengthen verbal encoding before independent recall.
Chunking	Divide verses by phrase, waqf, rhythm, or meaning unit	Learners reduce overload and process manageable units.
Semantic linking	Brief meaning explanation before or after memorization	Learners connect sound patterns with meaning networks.
Spaced muraja'ah	Daily, weekly, and monthly retrieval schedules	Learners stabilize older memorization and reduce forgetting.
Multisensory cues	Combine listening, reciting, writing, gesture, and visual markers	Learners use multiple routes for encoding and retrieval.

Sleep and rest awareness	Avoid excessive targets during fatigue; schedule review after rest	Learners support consolidation and reduce error accumulation.

4. CONCLUSION

This systematic literature review concludes that Qur'anic memorization is supported by a neurocognitive architecture that links working memory, memory consolidation, cognitive load control, and Islamic learning context. Working memory supports attention, phonological rehearsal, and temporary sequencing. Memory consolidation stabilizes memorized verses through muraja'ah, rhythm, semantic linking, multisensory learning, sleep-sensitive review, and repeated retrieval. These findings answer the research objective by showing that effective tahfidz learning depends on both initial processing and long-term stabilization.

The study contributes a Neuro-Tahfidz model that translates tahfidz practice into an empirical neuroeducational framework. It also extends memory research beyond common Western verbal stimuli by examining Qur'anic memorization as a rhymed, repetitive, non-Western sacred text. Future research should test this framework through experimental and longitudinal studies across pesantren, schools, and age groups. Such studies should measure working memory capacity, cognitive load, retention duration, recitation accuracy, and the effect of structured muraja'ah on long-term memory.

The revised synthesis also shows that tahfidz curriculum development can benefit from cognitive load theory. Teachers can set memorization targets based on learner capacity, verse complexity, review history, and fatigue level. This approach can make tahfidz learning more adaptive without weakening its religious character.

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