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Effectiveness of Mnemonics, Chunking, and Mind Mapping in Enhancing Memory and Knowledge Retention among Students: A Systematic Review

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Abstract

Introduction: Memory retention is one of the most significant academic challenges faced by nursing and many other students, who must encode and recall vast amounts of theoretical and clinical information. Mnemonics, chunking, and mind mapping are widely recommended cognitive strategies for enhancing memory, knowledge acquisition, and information retrieval in education.

Aim: This systematic review aims to synthesize available evidence on the effectiveness of mnemonics, chunking, and mind mapping — individually or in combination — in enhancing perceived memory, knowledge retention, and information retrieval among nursing, medical, secondary school, and high school students.

Method: A narrative systematic review of six primary studies conducted among nursing, medical, and school students in India and Thailand was undertaken. The reviewed studies employed experimental, quasi-experimental, and pre-experimental designs, including non-randomized control group, crossover, and pilot randomized designs, assessing knowledge, perceived memory, or short-term recall before and after interventions using mnemonics, chunking, and/or mind mapping.

Results: All six studies reported statistically significant improvements in perceived memory, knowledge, or recall scores following intervention or favouring the tested technique. Combined use of mnemonics, chunking, and mind mapping produced significant gains in perceived memory ($t=25.93$, $P<0.001$) and in a separate study a highly significant increase in post-test memory scores ($t=3.2131$, $P<0.001$). Video-assisted teaching on the same techniques produced a highly significant gain in knowledge scores in the experimental group ($t=35.26$) compared to the control group ($t=0.94$, not significant). Mind mapping alone significantly improved information retrieval and long-term retention compared to conventional reading or text-based study, with effect sizes ranging from moderate to large in one study and a significant one-week retention advantage ($P=0.03$) in another. Chunking of textual information into two or three groups significantly improved short-term recall of letters, numbers, and combined alphanumeric strings compared to presenting the same information as a single unbroken chunk.

Conclusion: The reviewed evidence consistently supports mnemonics, chunking, and mind mapping as effective, low-cost teaching strategies for enhancing memory and knowledge retention across nursing, medical, and school student populations. Structured integration of these techniques into curricula, supported by faculty training, is recommended to improve academic performance and reduce examination-related stress.

Keywords: Mnemonics, Chunking, Mind Mapping, Memory Enhancement, Nursing Students, Medical Students, Secondary School Students, Knowledge Retention, Systematic Review

Introduction

Memory is the mental process through which information is encoded, stored, and retrieved, and it underlies learning, decision-making, and clinical competence in nursing and medical practice. Nursing students face a considerable cognitive burden, needing to master approximately 3000 new vocabulary terms in their first year alone, and information retention has been identified as the single biggest academic challenge by 67% of nursing students, particularly in subjects such as anatomy, pharmacology, and pathophysiology. Similar challenges extend to medical students and secondary school learners, who must likewise retain large volumes of technical or curricular content under time pressure.

Difficulty with memory is not merely an academic concern; it has direct clinical consequences. Nursing students who report memory difficulties have been found to be 2.4 times more likely to develop clinical performance anxiety, underscoring the need for effective, evidence-based memory-enhancement strategies in health-professions and general curricula alike.

Three cognitive strategies have received particular attention in the education literature: mnemonics, which use acronyms, patterns, or associations to aid recall of procedural and factual knowledge; chunking, which organizes information into smaller, meaningful units to reduce cognitive load; and mind mapping, which visually organizes interconnected concepts to promote deep, conceptual understanding. Each technique is theorized to support a different aspect of learning — mnemonics for discrete facts, chunking for classification and procedural sequences, and mind mapping for conceptual relationships — suggesting that their combined or strategic use may offer complementary benefits.

Despite growing interest, there remains a need to consolidate the available evidence on how these techniques, applied individually or together, affect students' perceived memory, knowledge acquisition, and information retrieval. This systematic review synthesizes findings from six recent studies conducted among nursing, medical, and school students to address this gap.

Objectives

To systematically review and synthesize the available literature on the effectiveness of mnemonics, chunking, and mind mapping in enhancing memory, knowledge retention, and information retrieval among nursing, medical, and school students.

Materials and Methods

This narrative systematic review was conducted by identifying and analysing studies that evaluated mnemonics, chunking, and/or mind mapping as memory-enhancement or teaching-learning strategies among nursing, medical, or school student populations. Six eligible primary studies, conducted in India and Thailand, were included and their methodologies, interventions, and outcomes were extracted and compared.

Inclusion Criteria

1. Studies involving nursing, medical, or school students as participants
2. Studies evaluating mnemonics, chunking, and/or mind mapping as a learning or memory-enhancement intervention
3. Studies reporting quantitative outcomes on knowledge, perceived memory, or information retrieval
4. Studies published in English in peer-reviewed journals

Exclusion Criteria

1. Articles not available in full text
2. Studies not focusing on nursing, medical, or school student populations
3. Studies without a pre-test/post-test or comparative quantitative design
4. Non-peer-reviewed material

Results

Overview of Included Studies

Six studies met the inclusion criteria, together involving 528 nursing, medical, and school students across institutions in India (Puducherry, Pune, Dehradun, Bangaluru) and Thailand. Study designs included pre-experimental one-group pretest-posttest designs, quasi-experimental crossover and non-

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randomized control group designs, and an experimental pilot randomized study. All six studies assessed perceived memory, structured knowledge, or short-term recall before and after an intervention combining or isolating mnemonics, chunking, and mind mapping.

Effectiveness of Combined Mnemonics, Chunking, and Mind Mapping

Sankar et al. evaluated the combined application of mnemonics, chunking, and mind mapping among 80 first-year B.Sc. Nursing students in Puducherry using a 45-minute presentation on "Vital Signs." At pretest, 62.5% of students had inadequate perceived memory and 37.5% had moderate perceived memory, with none rated adequate. Following the intervention, 51.2% achieved moderate and 48.8% achieved adequate levels of perceived memory, with mean scores improving significantly from 9.88±2.821 to 16.18±2.151 (paired $t=25.93$, $P<0.001$).

Consistent with this, Negi et al. assessed a video-assisted teaching program covering all three techniques among 80 B.Sc. Nursing 2nd-semester students in Dehradun, using a non-randomized control group design. The experimental group's mean knowledge score rose from 8.125 to 20.225 (mean difference 12.1, $t=35.26$, $P<0.05$), while the control group showed negligible, non-significant change (9.45 to 9.7, $t=0.94$). This confirms that structured, video-based instruction in mnemonics, chunking, and mind mapping produces substantially greater knowledge gains than no intervention.

Similarly, Shalini and Sharmila conducted a one-group pretest-posttest study among 70 secondary school students (8th standard) in Harohalli, Karnataka, delivering daily 30-minute sessions on mnemonics, chunking, and mind mapping over 25 days. Post-test memory scores (mean 87.95, SD 6.59) were significantly higher than pre-test scores (mean 74.52, SD 11.40; paired $t=3.2131$, $P<0.001$). Memory level was significantly associated with gender ($P=0.037$), prior knowledge of memory techniques ($P=0.014$), and academic performance ($P=0.013$), though not with socioeconomic status or preferred study environment. This extends the evidence for combined-technique interventions beyond nursing students to a younger, secondary-school population.

Effectiveness of Mind Mapping in Isolation

Jabade and Nadaf examined mind mapping specifically, using a crossover design among 144 nursing students in Pune who learned two topics (AIDS syndrome and chronic renal failure), each taught once with mind mapping and once through conventional reading. Knowledge gained immediately after the intervention was significantly higher in the mind-mapping condition for both topics ($P<0.05$). Effect size analysis showed large effects for knowledge gained (Cohen's d up to 0.78) and moderate-to-large effects for long-term retention measured one month later. Student perception data showed that over 90% of students agreed mind mapping clarified learning objectives, improved understanding, and facilitated easy recall, with an overall favourable rating of 88.84%. Around 43% of students, however, perceived mind mapping as time-consuming, and faculty and student training emerged as a practical implementation challenge.

Kalyanasundaram et al. provided complementary evidence from medical education, conducting a pilot experimental study among 64 sixth-semester MBBS students in Puducherry. Students were randomized to learn an identical ~1500-word community medicine passage either by routine text reading (n=32) or by mind mapping (n=32). At baseline and immediately after the 20-minute intervention (Day 0), knowledge scores did not differ significantly between groups (baseline: 2.6 vs 3.5, $P=0.08$; Day 0: 8.7 vs 9.0, $P=0.26$). However, at Day 7, the mind-map group scored significantly higher than the text group (8.9 vs 8.5, $P=0.03$), indicating superior retention over time despite similar immediate learning gains. Students also rated the mind-map method significantly higher than text reading on confinement to the topic, understanding, objectives achieved, and overall rating (all $P<0.05$), though the study's own power analysis (69%) and small convenience sample limit the strength of these conclusions.

Effectiveness of Chunking in Isolation

Suppawittaya and Yasri investigated chunking specifically among 50 high school students in Thailand, testing recall of 10-item sequences of letters, numbers, and combined letter-number strings presented as One-Chunk, Two-Chunk, or Three-Chunk (4-3-3, 3-4-3, 3-3-4) formats. A single type of information (all letters or all numbers) was recalled

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significantly more accurately than combined alphanumeric strings (letters vs combined, P=0.020; numbers vs combined, P=0.001). For single-type information, dividing content into two or three chunks significantly improved recall over presenting it as one unbroken chunk — for example, Three-Chunk formats outperformed One-Chunk for both letters (P=0.003) and numbers (P=0.020). For combined alphanumeric information, the Two-Chunk format significantly outperformed both One-Chunk (P=0.013) and Three-Chunk (P=0.026) presentations, suggesting the optimal number of chunks may depend on the complexity of the material being learned. These findings provide a cognitive-mechanism explanation for why chunking, as used alongside mnemonics and mind mapping in the nursing and school-based studies above, aids recall — by keeping the number of items held in short-term memory within a manageable three-to-four-item range per chunk.

Synthesis of Findings

Across all six studies, interventions incorporating mnemonics, chunking, and/or mind mapping produced statistically significant improvements over baseline or control conditions, or over conventional study methods. The magnitude of improvement was consistently large, whether measured as perceived memory scores, structured knowledge scores, short-term recall accuracy, or effect sizes for information retrieval. Where techniques were compared or combined, mind mapping in particular showed durable benefits for long-term retention (evident at both one week and one month post-intervention), while mnemonics and chunking appeared best suited to procedural, classification-type, and short-term recall tasks, in line with the domain-specific advantages proposed in the underlying literature. The chunking-specific experimental evidence further clarifies the underlying cognitive mechanism, showing that dividing information into two-to-three meaningful groups reduces working-memory load and improves accurate recall, particularly for less familiar or combined material.

Discussion

The findings of this review indicate that mnemonics, chunking, and mind mapping are each effective, and jointly synergistic, strategies for enhancing memory and knowledge retention among nursing, medical, and school students. Mnemonics appear particularly suited to encoding discrete facts and procedural sequences through pattern-based association. Chunking reduces cognitive load by organizing complex material into manageable, related units, which is especially valuable given the sheer volume of new terminology nursing and medical students must master; the experimental chunking data reinforce this by showing that two-to-three item groupings measurably outperform ungrouped presentation, particularly for combined or less familiar content. Mind mapping, by contrast, supports the formation of conceptual, non-linear associations, aligning with contemporary theories of visual and interactive learning, and shows particular strength in promoting long-term retention and information retrieval — a pattern corroborated independently among both nursing students (one-month follow-up) and medical students (one-week follow-up).

A consistent theme across the reviewed studies is that structured, time-bound teaching interventions (ranging from a single 20- to 45-minute session to a multi-week programme of daily sessions) were sufficient to produce statistically significant gains, suggesting these techniques are feasible to implement within existing nursing, medical, and school curricula without extensive additional teaching time. At the same time, several studies identified practical challenges, including the need for adequate faculty and student training, the perception of mind mapping as time-consuming for some students, and — in the medical pilot study — a lack of significant immediate-term advantage despite a clear one-week retention benefit, suggesting the value of mind mapping may lie more in durable retention than in rapid initial learning.

The convergence of results across different institutions, sample sizes, age groups (secondary school through undergraduate health professions), and study designs strengthens confidence that these techniques are broadly applicable rather than context-specific. The addition of a controlled laboratory-style study on chunking further strengthens the internal validity of the review's conclusions, since its tightly controlled experimental design isolates the chunking mechanism from confounding instructional factors present in classroom-based studies. However, the relatively modest number of studies, their geographic concentration within India and Thailand, and their short follow-up periods (ranging from immediate post-test to one month) limit the generalizability of the

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findings and the ability to draw conclusions about long-term or cross-cultural effectiveness.

Limitations

1. Six primary studies were available for synthesis, conducted in India and Thailand, limiting generalizability to other educational and cultural contexts.
2. Follow-up periods were short (immediate post-test to one month), so long-term retention beyond this window remains unclear.
3. Sample sizes, though adequate for the individual studies, were modest overall (N=528 combined), and none of the included studies were large-scale randomized controlled trials; the medical pilot study explicitly reported only 69% statistical power.
4. Variability in intervention delivery (video-assisted teaching, live presentation, crossover training, laboratory-based recall testing) makes it difficult to isolate the independent contribution of each technique in studies where they were combined.
5. The chunking study used artificial letter/number sequences rather than curricular content, so its findings on optimal chunk size may not translate directly to classroom-based factual or conceptual learning.

Conclusion

This systematic review provides consistent evidence that mnemonics, chunking, and mind mapping — whether applied individually or in combination — significantly enhance perceived memory, knowledge acquisition, and information retrieval among nursing, medical, and school students. Mnemonics are best suited to procedural and factual recall, chunking to the organization of related concepts and short-term recall of discrete items, and mind mapping to conceptual understanding and long-term retention. Given their demonstrated effectiveness, feasibility, and low resource requirement, educators across nursing, medical, and secondary education should consider structured integration of these memory-enhancement techniques into theory and clinical teaching, supported by adequate faculty training, to improve academic outcomes and reduce students' memory-related academic stress.

Recommendations

1. Curricular Integration

- Incorporate mnemonics, chunking, and mind mapping formally into nursing, medical, and secondary school teaching, particularly for content-heavy subjects such as anatomy, pharmacology, and pathophysiology.
- Encourage student-generated mnemonics and mind maps, which have been associated with greater personalized engagement and retention.
- Apply chunking principles (grouping information into two-to-three meaningful units) when presenting lists, codes, or sequences to reduce working-memory load.

2. Faculty Training

- Provide structured faculty development sessions on designing and delivering mnemonic, chunking, and mind-mapping based instruction.
- Develop standardized teaching modules or video-assisted resources, given their demonstrated effectiveness in a single short session.

3. Further Research

- Conduct larger, multi-site, randomized controlled trials to strengthen causal evidence.
- Examine long-term (beyond one month) retention and clinical performance outcomes associated with these techniques.
- Explore the comparative and combined effectiveness of mnemonics, chunking, and mind mapping across diverse student populations and cultural contexts, including direct replication of chunking effects using curricular rather than artificial content.

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Summary of Evidence Table

S.No.	Author (Year)	Title of Study	Participants	Methods/Measurement	Results
1	Sankar C, VasanthaNila M, Nandakumar S, Neelakandan P, Suresh G (2025)	Mnemonics, Chunking, and Mind Mapping in Enhancing the Perceived Memory of Nursing Students	80 first-year B.Sc. Nursing students, Puducherry	Quantitative pre-experimental one-group pretest-posttest design. 20-item structured perceived memory questionnaire; 45-minute PowerPoint intervention on "Vital Signs" combining mnemonics, chunking, and mind mapping (15 min each); post-test after 1 week.	Pretest: 62.5% inadequate, 37.5% moderate perceived memory. Post-test: 51.2% moderate, 48.8% adequate. Mean score rose from 9.88±2.821 to 16.18±2.151 (paired t=25.93, P<0.001), showing highly significant improvement.
2	Jabade M, Nadaf H (2024)	Assessing the Efficacy of Mind Mapping as a Learning Technique to Enhance	144 nursing students, Pune City, Maharashtra (72 per group, crossover)	Quasi-experimental crossover design. Pre-test, immediate post-test, and 1-month retention test on two topics (AIDS syndrome	Knowledge gained immediately post-intervention was significantly higher with mind mapping for both topics (P<0.05).

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S.No.	Author (Year)	Title of Study	Participants	Methods/Measurement	Results
		Information Retrieval in Nursing Students		and chronic renal failure); mind mapping vs conventional reading; effect size via Cohen's d, Glass delta, Hedge g; Likert-scale perception survey.	Long-term retention after 1 month favoured mind mapping, with large effect sizes (Cohen's d up to 0.78). Over 90% of students agreed mind mapping clarified objectives and aided retrieval; 88.84% expressed an overall favourable view.
3	Negi S, Chanu MR, Sumalti S, Sain K (2025)	Effectiveness of Video Assisted Teaching Program Regarding the Knowledge of Mnemonics, Mind Mapping and Chunking to Enhance the Perceived Memory among B.Sc. Nursing Students	80 B.Sc. Nursing 2nd-semester students (40 experimental, 40 control), Dehradun, Uttarakhand	Quasi-experimental non-randomized control group design. 30-item structured knowledge questionnaire covering memory basics and the three techniques; video-assisted teaching program administered to the experimental group only.	Experimental group knowledge score rose from a pre-test mean of 8.125 to a post-test mean of 20.225 ($t=35.26$, $P<0.05$, significant), while the control group changed minimally (9.45 to 9.7, $t=0.94$, not significant), confirming the video-assisted program's effectiveness.
4	Kalyanasundaram M, Abraham SB, Ramachandran D, Jayaseelan V, Bazroy J, Singh Z, Purty AJ (2017)	Effectiveness of Mind Mapping Technique in Information Retrieval Among Medical College Students in Puducherry — A Pilot Study	64 sixth-semester MBBS students, Puducherry (32 text-reading, 32 mind-mapping)	Experimental pilot study; simple randomization into text-reading vs mind-mapping groups, each learning the same ~1500-word passage for 20 minutes. Knowledge assessed by a 10-item MCQ at baseline, Day 0, and Day 7; feedback rated on a Likert scale.	Baseline scores were comparable (2.6 vs 3.5, $P=0.08$). At Day 0, scores were similar between groups (8.7 vs 9.0, $P=0.26$). At Day 7, the mind-map group scored significantly higher than the text group (8.9 vs 8.5, $P=0.03$), indicating better retention. Students rated mind mapping significantly higher on topic confinement, understanding, objectives achieved, and overall rating ($P<0.05$).

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S.No.	Author (Year)	Title of Study	Participants	Methods/Measurement	Results
5	Shalini S, Sharmila J (2025)	Maximizing Memory Retention: The Power of Mnemonics, Chunking and Mind Mapping in Academic Success	70 secondary school students (8th standard), Harohalli, Karnataka	One-group pretest-posttest design. VARK Questionnaire and Modified PGI Memory Scale administered before and after a 4-week intervention (daily 30-minute sessions on mnemonics, chunking, and mind mapping for 25 days).	Post-test memory scores (mean 87.95, SD 6.59) were significantly higher than pre-test scores (mean 74.52, SD 11.40), with paired t=3.2131 (P<0.001). Memory level was significantly associated with gender (P=0.037), prior knowledge of memory techniques (P=0.014), and academic performance (P=0.013); no significant association with socioeconomic status or study environment.
6	Suppawittaya P, Yasri P (2020)	The Effectiveness of Chunking Methods for Enhancing Short-Term Memory of Textual Information	50 high school students, Thailand	Experimental design testing recall of 10-item sequences (letters, numbers, and combined letter-number strings) under One-Chunk, Two-Chunk, and Three-Chunk (4-3-3, 3-4-3, 3-3-4) presentation formats; paired t-tests (SPSS) compared recall accuracy across formats.	A single type of information (all letters or all numbers) was recalled more accurately than combined letter-number strings (P<0.05 for letters vs combined and numbers vs combined). For letters and numbers alone, Two- and Three-Chunk formats significantly outperformed One-Chunk (e.g., numbers 4-3-3 vs one-chunk, P=0.020). For combined information, the Two-Chunk format significantly outperformed both One-Chunk (P=0.013) and Three-Chunk (P=0.026).

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