# MAXIMIZING MEMORY RETENTION: THE POWER OF MNEMONICS, CHUNKING AND MIND MAPPING IN ACADEMIC SUCCESS

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**ABSTRACT**

**Background:** Memory is essential for learning and academic performance. Techniques such as mnemonics, chunking, and mind mapping are cognitive tools that enhance memory retention by making information easier to process and recall. This study focuses on evaluating the effectiveness of these methods among secondary school students, based on their preferred learning styles.

**Methods:** A one-group pretest-post-test design was adopted involving 70 secondary school students selected through non-probability convenience sampling. Tools were used to assess learning styles and memory levels. An educational intervention was conducted to train students in mnemonic techniques, chunking, and mind mapping. Pre- and post-test scores were compared to measure effectiveness. Associations between demographic variables and pre-test memory levels were also examined.

**Results:** post-intervention memory scores showed a significant increase compared to pre-test scores, indicating improved memory retention. Statistical analysis revealed a highly significant difference (p < 0.001), confirming the effectiveness of the implemented memory strategies.

**Conclusion:** The study demonstrates that mnemonic techniques, chunking, and mind mapping significantly enhance memory levels among secondary school students. Incorporating these cognitive strategies into educational practice may improve students' learning outcomes and academic success. Further research is recommended to investigate long-term impacts and implementation strategies across diverse educational settings.

**Keywords:** Memory; Mnemonic techniques; Chunking; Mind Mapping

## INTRODUCTION

Memory is the cognitive ability to retain and reproduce learned information, playing a key role in learning and recall. Retention, a major challenge for students, reflects how much information is remembered versus forgotten. While often associated with verbal memory, real-life memory also includes non-verbal elements like faces, places, and sensory experiences. Thus, memory extends beyond verbal recall to encompass various forms of cognitive retention.(1) Memory is essential for learning and psychological growth, enabling individuals to recall past experiences for problem-solving and critical thinking. It allows the storage and retrieval of learned information, with memorization success influenced by learning methods, individual traits, and the learning environment.(2)

This study focuses on evaluating the effectiveness of mnemonics, chunking, and mind mapping in enhancing memory among secondary school students. The introduction highlights various memory enhancement techniques, with particular emphasis on these three strategies, offering a comprehensive overview of their application and significance in educational settings.

Mnemonic techniques, rooted in ancient Greek traditions, have long been used to aid memory. Key methods include the **method of loci**, which links familiar spatial locations to information for recall, and the **peg word method**, which involves associating rhyming number-word pairs with visualized content. These strategies enhance memory through structured, imaginative associations.(3) Memory pegs act as mental hooks for storing information, similar to hanging items on pegs in a clock room of the mind. These reminder cues help in systematically recalling the information associated with them.(4) The keyword method links new information to existing concepts in memory. Unusual or humorous mnemonics, even if nonsensical, tend to be more memorable than plain facts due to their distinctiveness.(3)

Chunking is a memory technique that breaks down information into smaller, meaningful units, making it easier to recall. For instance, grouping digits of an account number into familiar patterns, like a birthday or exam score, can significantly enhance memory retention.(5) Chunking leverages the limited capacity of short-term memory by grouping information into larger, meaningful units. For example, instead of remembering 64831996 as eight separate digits, it can be chunked into 64, 83, and 1996—reducing memory load and enhancing recall, especially when the chunks are familiar.(2)

Mind mapping is a visual technique that helps students organize and connect ideas using colors, illustrations, and structured diagrams. It simplifies complex information, enhances memory retention, and supports better comprehension. By actively engaging with content through creative visuals, students experience more meaningful learning. Mind maps also aid teachers in lesson planning and content delivery.(6)

The primary objective of this study is to evaluate the impact of mnemonics, chunking, and mind mapping on memory enhancement among secondary school students. It also aims to guide future research in exploring the most effective use of these techniques for different types of information and to gain deeper insights into the workings of human memory.

## SIGNIFICANCE OF THE STUDY

Information Processing Theory, proposed by Atkinson and Shiffrin (1968), explains memory as a multi-stage process involving sensory input, short-term storage, and long-term encoding and retrieval. It describes how the brain receives, organizes, and retains information for future use.(2) According to cognitive scientist Art Kohn, individuals forget approximately 50% of new information within an hour, 70% within 24 hours, and up to 90% within a week.(7) Many high school students face cognitive challenges like poor concentration and memory, impacting their academic performance. A 2019 CDC survey found that 38% reported serious cognitive issues, especially among girls and those with mental health or psychosocial problems, highlighting the need for supportive interventions.(8) A cross-sectional study assessing secondary school students' awareness of working memory and memory techniques found low awareness levels, with 43.3% lacking understanding of working memory and 37.8% unfamiliar with memory strategies.(9) The article by Babalola and Umar highlights how students with low academic achievement face stress and anxiety due to factors like poverty, competition, and COVID-19. It advocates using mindfulness strategies, especially mnemonics, in teaching to reduce stress and improve learning and retention in subjects like Chemistry and English.(10) Concentration and memory are closely linked cognitive functions. Lack of focus in class affects information retention, while strong concentration without memory is ineffective. A study involving 2132 students (1352 males, 780 females) from grades 8 to 10 found that male students reported more difficulties with concentration and memory than females, based on simple self-reported questions.(11) A pre-experimental study on 95 BSc Nursing students found that memory-enhancement techniques (METs) significantly improved memory retention, with students moving from average to above-average MMQ levels post-intervention.(12) This study emphasizes the role of memory in student success and explores how memory-enhancement techniques can improve retention and learning. It offers insights for educators to integrate practical strategies that reduce academic stress and enhance outcomes.

## RESEARCH METHODOLOGY

### Design
A pre-experimental, one-group pretest-posttest design was employed in this study.

### Research questions
1. What are the preferred learning styles among secondary school students?
2. What is the baseline memory level of secondary school students before the intervention?
3. Is there a significant difference between pre-test and post-test memory scores after implementing memory-enhancement techniques?
4. Is there any association between memory levels and selected demographic variables (e.g., age, gender, academic performance)?

### Setting and Sample
The study included all secondary school students studying in Pragathi Vidyanikethana School at Harohalli who met the inclusion criteria. So, participation in the study was voluntary, with oral consent obtained from all participants. Participants were informed about the study's purpose and nature. Confidentiality and anonymity were ensured, and they had the right to refuse participation or withdraw from the study at any time without consequences. This study was conducted among 70 secondary school students selected through non-probability convenience sampling technique.

### Data Collection
The main study was conducted during February and March 2024 at Pragathi Vidyanikethana School, Harohalli. A total of 70 secondary school students who met the inclusion criteria were selected using a convenience sampling technique. Data collection involved the use of Demographic Variables, the VARK Questionnaire, and the Modified PGI Memory Scale through interview method. Formal permission was obtained from the school director. Participants were informed about the study and oral consent was secured. Pre-test data were collected over 3 days. The study was conducted over 4 weeks. Participants were divided into two groups of 35 each. Daily 30-minute sessions on mnemonics, chunking, and mind mapping were conducted for 25 days. Post-test was conducted after the intervention using the same tools.

### Instrument
To accomplish the objectives of the study, the following tools were utilized:

**Part 1**: Demographic Variables
This section included 8 items to collect baseline data on age, gender, class level, socio-economic status, type of school, previous knowledge, academic performance, and preferred study environment.
**Part 2:** VARK Questionnaire (Version 8.01)
A standardized and validated tool developed by Neil D. Fleming, used to identify students' preferred learning styles (Visual, Aural, Read/Write, Kinaesthetic, or combinations)(13). The questionnaire comprises 16 items. Scores were interpreted to categorize participants into unimodal or multimodal learners based on their responses. Permission for use was obtained from Heather Lander, Manager.
**Part 3:** Modified PGI Memory Scale
This tool, developed by the researcher, consisted of 10 subtests assessing various memory domains including immediate recall, delayed recall, attention, visual retention, and recognition.
**Data Analysis**
Data were analysed using SPSS version 23. Descriptive analysis was conducted to determine means, frequencies, and percentages. Paired 't' test was used to assess the effectiveness of mnemonics, chunking, and mind mapping on memory levels among secondary school students. Chi-square test determined the association between memory levels and selected demographic variables.
**Ethical Consideration**

<div align="center">

**RESULT**

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**Table 1: Socio-demographic Characteristics of the Student Study Sample (n=70)**

| SL. NO | DEMOGRAPHIC VARIABLES | FREQUENCY (f) | PERCENTAGE (%) |
|---|---|---|---|
| 1 | **AGE IN YEARS** | | |
| | a) Below 14 years | 0 | 0 |
| | b) 14 - 15 years | 70 | 100 |
| | c) 16 - 17 years | 0 | 0 |
| | d) 18 years above | 0 | 0 |
| 2 | **GENDER** | | |
| | a) Male | 31 | 44 |
| | b) Female | 39 | 56 |
| 3 | **CLASS/GRADE LEVEL** | | |
| | a) 7<sup>TH</sup> Standard | 0 | 0 |
| | b) 8<sup>TH</sup> Standard | 70 | 100 |
| | c) 9<sup>TH</sup> Standard | 0 | 0 |
| | d) 10<sup>TH</sup> Standard | 0 | 0 |
| 4 | **SOCIO-ECONOMIC STATUS** | | |
| | a) Lower middle class | 0 | 0 |
| | b) Middle class | 31 | 44 |
| | c) Upper middle class | 34 | 49 |
| | d) Upper class | 5 | 7 |
| 5 | **TYPE OF SCHOOL** | | |
| | a) Public | 0 | 0 |
| | b) Private | 70 | 100 |
| 6 | **PREVIOUS KNOWLEDGE OF MNEMONICS, CHUNKING, MIND MAPPING** | | |
| | a) Yes | 25 | 36 |
| | b) No | 45 | 64 |
| 7 | **PREFERRED STUDY ENVIRONMENT** | | |
| | a) Quiet room at home | 40 | 57 |
| | b) Group study with friends | 27 | 39 |
| | c) Library | 3 | 4 |

| | | | |
|---|---|---|---|
| | d) Others | 0 | 0 |
| 8 | **RATE THE ACADEMIC PERFORMANCE** | | |
| | a) Excellent | 30 | 43 |
| | b) Good | 34 | 48.5 |
| | c) Average | 6 | 8.5 |
| | d) Below average | 0 | 0 |

Table 1 summarizes the sociodemographic characteristics of the study sample. All students were aged between 14–15 years, with a slightly higher number of females. All participants were from the 8th standard and attended private schools. Most belonged to middle or upper middle-class families. A majority had no prior knowledge of memory techniques, preferred studying in a quiet room, and rated their academic performance as good or excellent.

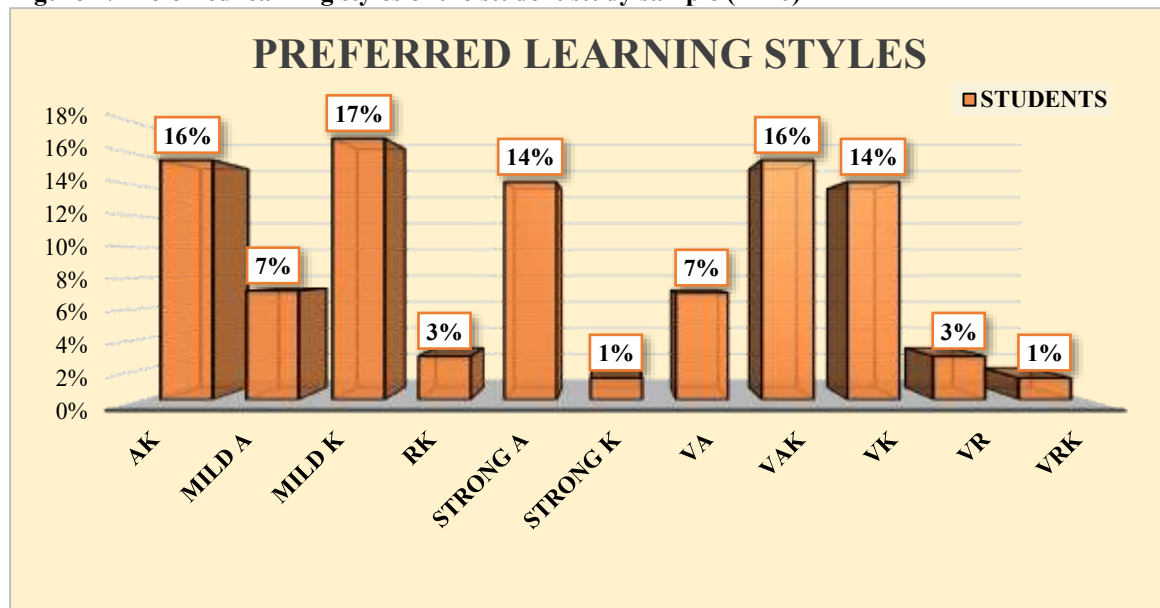**Figure 1: Preferred learning styles of the student study sample (n=70)**



Figure 1 shows the preferred learning styles of the students. The most commonly preferred styles were Mild Kinesthetics (17%), AK and VAK (both 16%), followed by Strong Auditory and VK (both 14%). Least preferred styles included Strong Kinesthetics and VRK (1% each).

**Table 2: Paired T-test between Pre-test and Post Test level of memory (n=70)**

| COMPONENT | OBERVATION | MEAN | SD | PAIRED T TEST | T VALUE |
|---|---|---|---|---|---|
| MEMORY LEVEL | PRE-TEST | 74.52 | 11.40 | 13.80 | 3.2131*** |
| | POST-TEST | 87.95 | 6.59 | | |

Table 2 presents the comparison of memory levels before and after the intervention. The mean post-test score (87.95) was significantly higher than the pre-test score (74.52), with a paired t-value of 3.2131 ($p < 0.00$), indicating a statistically significant improvement in memory levels after the intervention.

**Table 3: Association between the level of memory among secondary school students with their selected demographic variables. (n=70)**

| DEMOGRAPHIC VARIABLES | PRE-TEST MEMORY LEVEL | | | | Chi square ($\chi^2$) | P value |
|---|---|---|---|---|---|---|
| | Good Memory | Low Memory | Very Good Memory | Very Low Memory | | |

| Gender | | | | | | |
|---|---|---|---|---|---|---|
| Female | 5 | 11 | 11 | 12 | 8.49 | 0.037* |
| Male | 1 | 8 | 3 | 19 | | |
| Socioeconomic status | | | | | | |
| Middle Class | 2 | 10 | 4 | 15 | 3.84 | 0.698 |
| Upper class | 0 | 2 | 1 | 2 | | |
| Upper middle class | 4 | 7 | 9 | 14 | | |
| Previous knowledge | | | | | | |
| No | 1 | 16 | 7 | 21 | 10.62 | 0.014* |
| Yes | 5 | 3 | 7 | 10 | | |
| Preferred study environment | | | | | | |
| Group | 3 | 2 | 7 | 15 | 9.96 | 0.126 |
| Home | 3 | 16 | 7 | 14 | | |
| LB | 0 | 1 | 0 | 2 | | |
| Academic performance | | | | | | |
| Average | 0 | 0 | 0 | 6 | 16.15 | 0.013* |
| Excellent | 4 | 9 | 10 | 7 | | |
| Good | 2 | 10 | 4 | 18 | | |

**\*p<0.05 – Statistically significant**

Table 3 shows the association between selected demographic variables and pre-test memory levels. A significant association was found with gender (p = 0.037), previous knowledge of memory techniques (p = 0.014), and academic performance (p = 0.013). No significant association was observed with socioeconomic status (p = 0.698) or preferred study environment (p = 0.126).

## DISCUSSION

This study highlights the impact of preferred learning styles on memory enhancement in secondary school students, with multimodal preferences, particularly kinesthetic and auditory, proving most effective. These findings align with research suggesting that matching teaching methods to student preferences enhances learning outcomes(14,15).

The preference for multimodal learning styles, especially in complex fields like healthcare, reflects the need for adaptive educational strategies that evolve with students' academic progress(16,17). This shift from unimodal to multimodal preferences as students advance in their studies underscores the importance of catering to evolving learning needs(18,19).(Nwuba, 2022) This underscores the importance of integrating learning style-based strategies into educational practices for better academic outcomes.

The present study aimed to assess the effectiveness of mnemonics, chunking, and mind mapping in enhancing the memory levels of secondary school students. The findings provide meaningful insights into the impact of these memory techniques on students' existing study techniques and their overall memory retention. Specifically, mnemonic devices have been found to significantly improve academic achievement when integrated into instruction, as evidenced by previous studies(20).

The study found that mnemonic devices significantly enhanced students' memory, which is consistent with findings that show integrating such techniques in teaching can improve academic outcomes. The use of mnemonic strategies led to notable improvements in memory levels among students, confirming their effectiveness in enhancing academic performance(21).

Mind mapping, as a memory-enhancing tool, also showed positive results in this study. Previous research has demonstrated that mind mapping significantly improves retention and memory, with students who used mind mapping outperforming those taught using traditional methods. This technique aids in visualizing and organizing information, thereby enhancing retention and recall(22).

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Overall, the findings of this study support the conclusion that mnemonic devices and mind mapping are effective strategies for improving memory retention and academic performance in secondary school students.

Chi-square analysis showed a significant association between memory level and gender, previous knowledge, and academic performance ($p < 0.05$). No significant link was found with socio-economic status or preferred study environment ($p > 0.05$). Variables like age, class level, and school type were excluded due to sample uniformity. This is supported by a study where mnemonic training improved memory regardless of educational background, highlighting the role of training over demographics (23). The study highlights that memory enhancement strategies like mnemonics, chunking, and mind mapping significantly improved students' memory levels. These findings reinforce the importance of aligning teaching methods with learners' cognitive preferences and demographic influences.

**Limitation**

The study included only secondary school students, limiting the generalizability of the findings. The absence of a control group made it challenging to control for extraneous variables that may have influenced the outcomes.

## CONCLUSION

In conclusion, the present study highlights the significant role of mnemonic techniques such as chunking and mind mapping in enhancing memory among secondary school students. The findings emphasize the importance of adopting innovative, learner-centered strategies tailored to students' cognitive needs. These methods not only improved memory performance but also demonstrated a strong association with academic variables, suggesting their broader application in educational settings. The study lays a foundation for future research exploring the long-term impact and adaptability of such memory enhancement techniques across diverse student populations.

**Recommendations**

Based on these findings, it is recommended that educators integrate mnemonic techniques, such as chunking and mind mapping, to enhance memory and academic performance. Future research could explore comparative studies between urban and rural settings, use larger sample sizes for greater generalizability, and conduct longitudinal studies to assess the long-term effects of memory training techniques.

## ACKNOWLEDGEMENT

**Conflict of Interest**

The authors hereby confirm that they don't have any conflict of interest related to the manuscript.

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