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RESEARCH ARTICLE

Effects of an Eight-Week Trataka Practice on Attention Performance Among University Students: A Controlled Pre–Post Experimental Study

Roopa Sharma[1], Garima Jaiswal[2], Umesh Kumar[3]

[1] Research Scholar, Amity Institute of Indian System of Medicine, Amity University, Noida, Uttar Pradesh, India

[2] Assistant Professor, Swami Rama Himalayan University, India

[3] Assistant Professor, Amity Institute of Indian System of Medicine, Amity University, India

Editorial queries: admin@chirantanjournal.in

ORCID: Roopa Sharma 0009-0000-6820-3101; Umesh Kumar 0009-0003-8498-7411

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ABSTRACT

Attention is a fundamental cognitive function that enables humans to selectively process relevant information while inhibiting distractors. The growing academic burden, digital multitasking, and psychological stress among university students have adversely impacted their attention span and overall cognitive performance. This study investigates the effect of a structured focused attention training module on cognitive alertness among university students. A sample of 40 students was recruited and randomly divided into an experimental group (n=20) and a control group (n=20). Pre- and post-test attention scores were recorded using a standardized attention assessment tool. As reported in the original dissertation, the mean pre-test score was 36.55 ± 9.08, which significantly improved to 23.36 ± 6.86 following the intervention, indicating enhanced alertness ($p < 0.05$). The results support the hypothesis that attention training practices rooted in traditional meditative techniques such as Trataka, breath awareness, and sensory withdrawal can significantly improve cognitive performance. The findings have strong implications for integrating cognitive training modules into academic settings to counter mental fatigue and improve student productivity.

KEYWORDS

Trataka; cognitive function; Students; Attention; yoga

1. Introduction

Attention is one of the most essential cognitive abilities governing human functioning, learning, and behavior. (Pramanik & Chatterjee, 2024) It acts as the gateway through which information enters the mind, enabling individuals to filter relevant stimuli, ignore distractions, and channel mental resources toward purposeful activity. For students, attention is particularly crucial because it directly influences comprehension, memory formation, academic productivity, and overall psychological well-being. (Kakkar et al., 2025; Yadav & Rathore, 2022) A well-functioning attentional system allows learners to stay engaged during lectures, perform complex mental operations, and maintain accuracy under time-bound conditions. However, in recent decades, university students have been increasingly exposed to environments that challenge their ability to concentrate. The rise of digital technology, prolonged screen exposure, multitasking behaviors, academic pressure and fast-paced lifestyles have collectively contributed to declining attention spans. Many students report difficulty sustaining focus, frequent mind-wandering, and mental fatigue, all of which interfere with effective learning and reduce academic efficiency (Swathi et al., 2021). Modern life places continuous demands on cognitive systems, often overwhelming the natural capacity of the mind to remain stable and centered.

At the same time, psychological and contemplative traditions emphasize that attention is not a fixed trait but a skill that can be refined through systematic practice. Techniques such as focused observation, breath awareness, and sensory regulation are believed to strengthen the mind's ability to concentrate by reducing internal noise and enhancing mental clarity. (Ghosal & Kabi, 2024; Shah et al., 2024) These practices promote calmness, improve cognitive control, and cultivate a deeper sense of awareness. When practiced regularly, such techniques can improve selective attention, sustained focus, and the ability to manage distractions - qualities that are essential for academic success and emotional balance. (Chaudhary et al., 2024; Josefsson et al., 2014)

Focused attention training is one such approach that involves intentionally directing awareness toward a single target - such as a visual object, a point in space, or the breath - while consciously disengaging from irrelevant stimuli (Krisanaprakornkit et al., 2010). By repeatedly bringing the mind back to the chosen point of focus, individuals develop better control over their attentional processes. (Pandya, 2024) This training enhances stability of attention, reduces impulsive shifting of focus, and strengthens executive functioning.

Given the increasing cognitive demands placed on students and the growing concern regarding reduced attention in academic settings, there is a need to explore effective, non-pharmacological strategies that can improve attentional performance. Focused attention training offers a simple, structured, and cost-effective method that can be integrated into daily routines without requiring specialized equipment or extensive time commitments.

The present study investigates the effect of a structured focused attention training program on cognitive alertness among university students. By evaluating changes in attention before and after the intervention and comparing them with a control group, the study aims to provide empirical insight into the potential of attention-enhancing practices to improve cognitive performance in young adults. This research contributes to the broader understanding of how intentional mind-training techniques can support academic effectiveness, mental clarity, and overall cognitive health in the student population.Attention is a core cognitive process involved in selecting relevant information, maintaining task goals, and regulating responses to competing stimuli. Classical theories describe attention as a limited system in which selection determines which information receives further processing (Broadbent, 1958; Treisman, 1964; Deutsch & Deutsch, 1963). For university students, effective attention is important for learning, reading, problem solving, and performance on time-limited tasks.

Attention is not necessarily static. Behavioural and contemplative training approaches have been investigated as methods for improving aspects of attentional control. Mindfulness and meditation research suggests that repeated practice may influence executive attention and related cognitive processes, although effects vary by intervention, population, and outcome measure. Importantly, the present study focuses specifically on Trataka rather than treating all meditative or yogic practices as interchangeable.

Trataka is traditionally described as a yogic visual-concentration practice involving steady gazing at a selected object, commonly a candle flame. Classical yoga literature places practices of concentration within a broader framework of mental discipline, while modern experimental studies have examined Trataka using behavioural and cognitive outcomes. An immediate-effect study reported better Stroop performance after Trataka than a control condition, suggesting possible benefits for selective attention and response control (Raghavendra & Singh, 2016). A controlled study in older adults also reported improvements in selected cognitive functions following Trataka practice (Talwadkar et al., 2014). More recently, a repeated-measures study found improvements in working/spatial memory and spatial attention following Trataka training (Swathi et al., 2021). These findings support continued investigation but do not establish a single mechanism or guarantee generalization to university students.

Letter-cancellation tasks are commonly used to assess visual search, sustained/selective attention, concentration, and rapid response processes. Indian normative work on the Six Letter Cancellation Test (SLCT) has documented its use as an attention-related psychomotor task and reported test–retest reliability (Pradhan & Nagendra, 2008). The Trail Making Test provides complementary information: TMT-A primarily reflects visuoperceptual tracking and processing speed, whereas TMT-B additionally places demands on divided attention, set-shifting, and cognitive flexibility (Kounatidis et al., 2024).

Despite prior work on Trataka, there remains a need for controlled studies examining a sustained intervention period and using more than one behavioural measure of attention in young adults. The present study therefore examined an eight-week Trataka-based practice in university students. The novelty lies in the duration and controlled pre–post design, together with the use of both a letter-cancellation measure and TMT-A/B to

characterize changes across related but distinct aspects of attention performance. The study was not designed to establish neurophysiological mechanisms.

2. Conceptual Foundations of Attention and Its Yogic Training

2.1 Psychological Perspective of Attention

The study provides an extensive explanation of attention as a core psychological construct. It describes attention as:

Selective – focusing on one stimulus while ignoring others.

Dynamic – constantly shifting according to internal and external cues.

Limited – restricted in capacity, thus requiring training to improve efficiency.

Psychologists argue that attention directly shapes consciousness and influences the efficiency of mental operations.

2.2 Types of Attention

Based on this study, attention is broadly categorized into:

Focused Attention

Engagement with a single stimulus or task, essential for academic focus.

Sustained Attention

Ability to maintain concentration over a prolonged duration.

Divided Attention

Ability to process multiple stimuli simultaneously.

The study specifically targets focused attention, which is crucial for learning, reading comprehension, and examination performance.

2.3 Determinants of Attention

The Study lists factors such as:

intensity and novelty of stimulus

prior knowledge

interest

emotional state

mental fatigue

These determinants highlight that attention is modifiable and influenced by both internal and external conditions.

2.4 Yogic and Meditative Approaches to Attention Training

Yogic texts emphasize practices such as:

Trataka – concentrated gazing at a fixed point.

Breath Awareness – observing the natural flow of breath.

3. Methodology

3.1 Study Design

This study used a controlled pre–post experimental design with an experimental group and a non-intervention control group. Pre-intervention and post-intervention attention measures were collected using the same assessment battery. The original analysis emphasized within-group pre–post comparisons; no retrospective claim of a prespecified between-group inferential model is made.

3.2 Participants and Sampling

A total of 40 university students aged 18–25 years participated in the study, with 20 participants in the experimental group and 20 in the control group. Participants were selected using the eligibility criteria described below. The source manuscript describes purposive recruitment and also states that participants were divided into

two groups; because the available study record does not provide a documented allocation procedure, the revised manuscript does not make a stronger claim about randomization.

3.3 Inclusion and Exclusion Criteria

Inclusion Criteria

Students aged 18–25 years

Normal or corrected sensory functioning (vision and hearing)

Willingness to participate and follow the training schedule

Ability to understand instructions and perform tasks independently

Exclusion Criteria

History of neurological disorders

Ongoing psychological treatment

Diagnosed attention-related disorders

Use of medication affecting alertness

3.4 Intervention Protocol

The principal intervention was Trataka (candle-gazing/visual concentration). Participants sat comfortably and focused their gaze on a candle flame positioned at eye level under instructor supervision. Each session began with a brief yoga prayer and ended with approximately 3–4 minutes of meditation. The complete session lasted approximately 25–30 minutes, six days per week, for eight weeks, yielding 48 planned sessions. The prayer and closing meditation were standardized session components, whereas Trataka was the primary therapeutic practice under investigation.

Participants received initial supervision to establish the practice procedure. The intervention was delivered by a trained instructor. No additional breath-awareness or pratyāhāra practice is treated as an independent intervention component in this revised manuscript.

1. Trataka (Candle Gazing)

Participants sat comfortably, focusing their gaze on the flame of a candle placed at eye level. This practice aims to improve visual concentration, stabilize eye movements, and reduce mental fluctuations. Sessions lasted 10–15 minutes.

2. Breath Awareness Practice

Participants observed the natural flow of breath without altering its rhythm. This technique reduces internal cognitive noise, calms the autonomic nervous system, and improves sustained attention. Sessions lasted 10 minutes.

3.5 Control Group

The control group did not receive any intervention and continued their regular academic and daily activities. No attention-based practices, meditation, or cognitive tasks were introduced to them during the study. The purpose was to provide a baseline comparison against natural variations in attention.

3.6 Outcome Assessment

Two standardized behavioural assessment approaches were used. The Six Letter Cancellation Test (SLCT) was used to assess performance involving visual scanning, selective/sustained attention, concentration, and rapid response. Published Indian normative work supports the use of the letter-cancellation task for attention-related assessment and reports test–retest reliability (Pradhan & Nagendra, 2008). For SLCT interpretation, higher total and net attempts indicate greater task output, whereas fewer wrong attempts indicate better accuracy.

The Trail Making Test was used in Parts A and B. TMT-A completion time primarily reflects visuoperceptual tracking and processing speed, while TMT-B additionally requires divided attention, set-shifting, and cognitive flexibility. For both TMT-A and TMT-B, lower completion time indicates better performance (Kounatidis et al., 2024). This scoring direction is stated here before presentation of the results to avoid ambiguity.

A standardized Attention Assessment Test was administered before and after the intervention. The test measured various dimensions of focused attention, including:

Reaction time

Ability to filter distractions

Consistency and accuracy in task performance

Concentration span

A lower score after intervention indicated better performance (i.e., higher attention efficiency).

3.7 Outcomes and Interpretation

The study outcomes were total attempts, wrong attempts, and net attempts on the SLCT, together with completion time on TMT-A and TMT-B. The original study record does not document a pre specified primary-versus-secondary hierarchy; accordingly, the revised manuscript does not retrospectively impose one. Interpretation is limited to the cognitive domains reasonably represented by each measure.

3.7.1 Sample Size and Power

The final sample comprised 40 participants (20 per group) each group sample size were calculated by G-power software.

3.8 Statistical Analysis

Pre- and post-intervention scores were compared using the paired t-test, a statistical method appropriate for measuring changes within the same group. A p-value of less than 0.05 was considered statistically significant. The control group's scores were also analyzed to confirm that no significant change occurred in the absence of training.

4. Results

The primary objective of this study was to determine the effect of focused attention training on cognitive alertness among university students. A comparison of pre-test and post-test attention scores revealed a substantial improvement in the experimental group following the intervention. The descriptive and inferential outcomes are presented below.

SLTC (Six Letter Cancellation Test) TABLE

Variables	Groups	Pre (M ± SD)	Post (M ± SD)	df	t-value	p-value
TOTAL ATTEMPT	Experimental group	40.350 ± 10.77	58.500 ± 16.81	19	4.992	0.000
TOTAL ATTEMPT	Control group	34.050 ± 6.66	33.3 ± 6.74	19	0.844	0.409
WRONG ATTEMPT	Experimental group	0.550 ± 1.27	0.35 ± 0.812	19	0.567	0.577
WRONG ATTEMPT	Control group	1.00 ± 1.447	1.650 ± 0.670	19	-1.314	0.204
NET ATTEMPT	Experimental group	39.85 ± 10.06	58.150 ± 16.14	19	-5.116	0.000
NET ATTEMPT	Control group	33.950 ± 6.56	32.350 ± 6.832	19	-1.2	0.245

Table 1 Pre-test and Post-test Comparison of Total Attempts, Wrong Attempts, and Net Attempts between Experimental and Control Groups

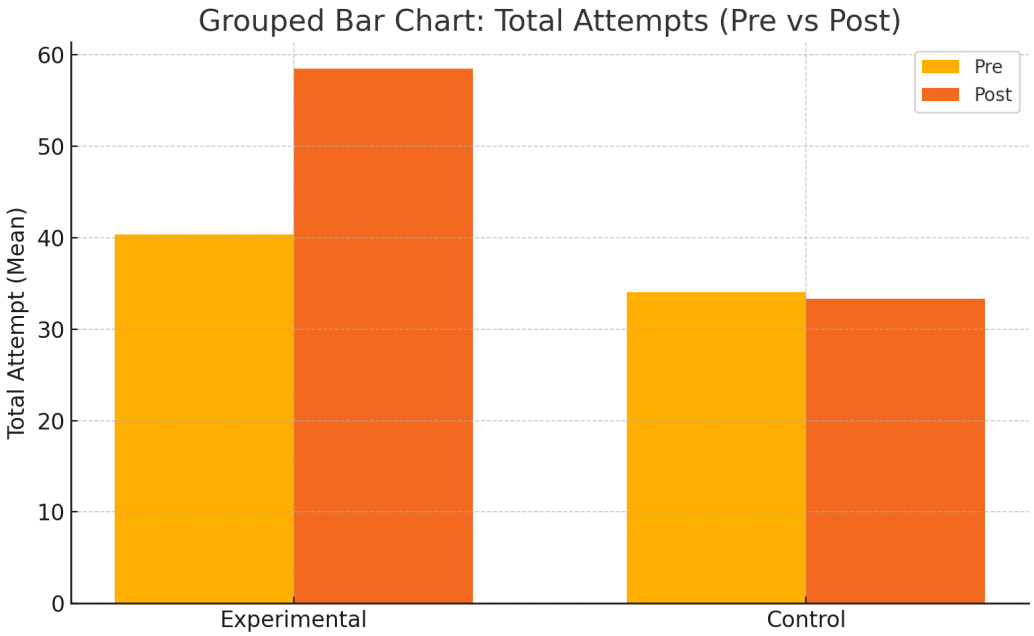

Figure 1 Grouped Bar Chart showing Pre-test and Post-test Total Attempts for Experimental and Control Groups

Alt text: Grouped bar chart comparing pre-test and post-test total attempts between experimental and control groups

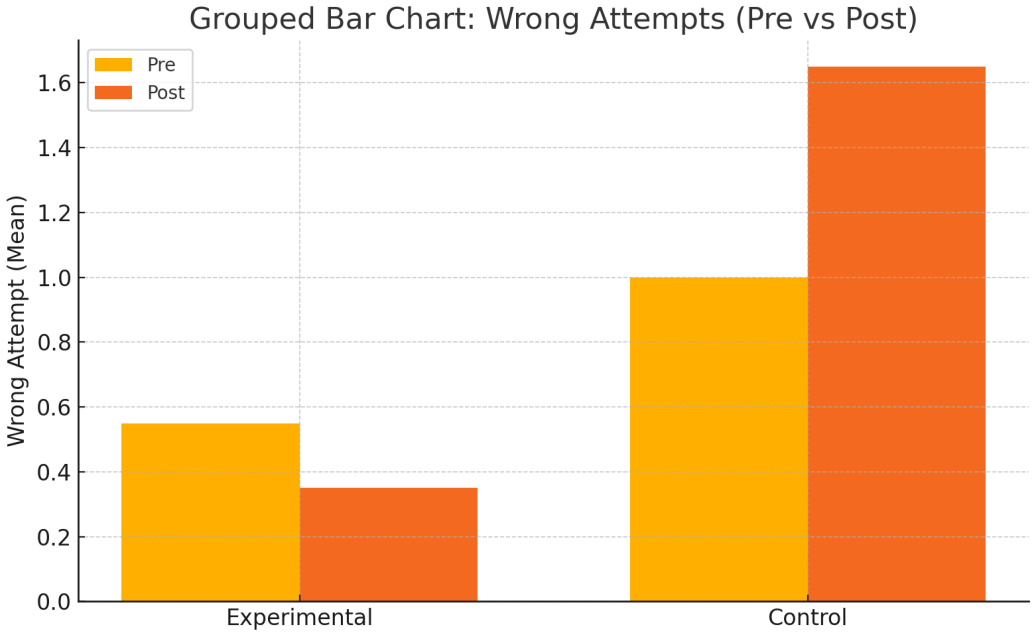

Figure 2 Grouped Bar Chart illustrating Pre-test and Post-test Wrong Attempts for Experimental and Control Groups

Alt text: Grouped bar chart comparing pre-test and post-test wrong attempts between experimental and control groups

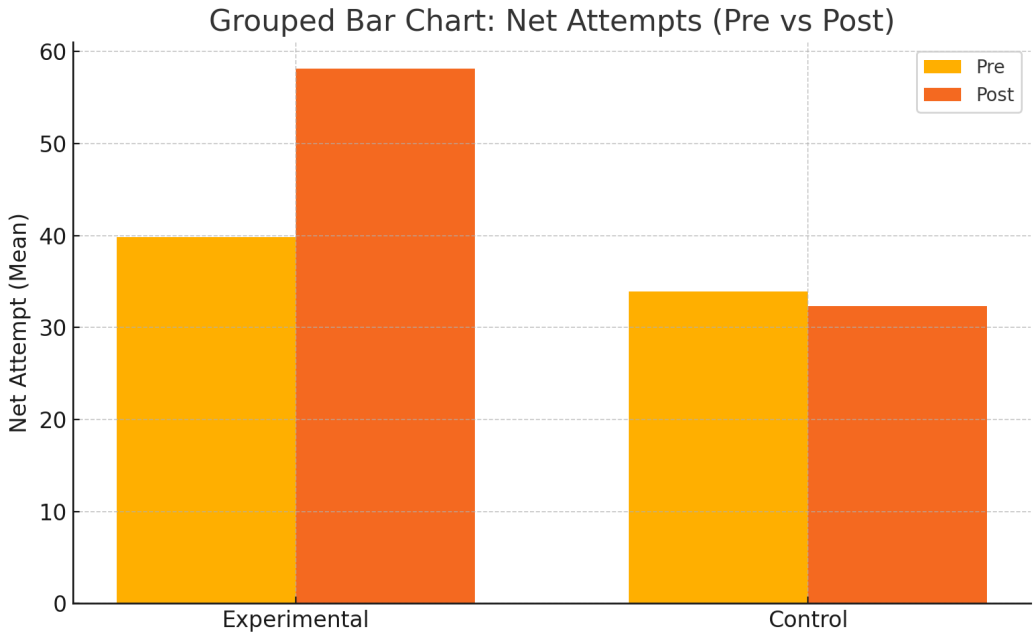

Figure 3 Grouped Bar Chart depicting Pre-test and Post-test Net Attempts for Experimental and Control Groups

Alt text: Grouped bar chart comparing pre-test and post-test net attempts between experimental and control groups

Combined Interpretation of Total Attempt, Wrong Attempt, and Net Attempt Bar Charts

The combined analysis of the three bar charts - Total Attempts, Wrong Attempts, and Net Attempts - clearly demonstrates the effectiveness of the intervention administered to the experimental group. Across all indicators, the experimental group showed notable improvements from pre-test to post-test, whereas the control group displayed minimal change or slight declines.

The Total Attempts chart shows a significant increase in the number of items attempted by the experimental group, rising from 40.35 to 58.50, indicating improved processing speed, attention span, and task engagement after the intervention. Meanwhile, the control group exhibited a slight decrease from 34.05 to 33.30, suggesting no natural improvement without intervention.

The Wrong Attempts chart further strengthens this observation. The experimental group's errors decreased from 0.55 to 0.35, demonstrating enhanced accuracy and better cognitive control during the task. In contrast, the control group's wrong attempts increased from 1.00 to 1.65, indicating a reduction in accuracy and suggesting performance fatigue or inconsistency in the absence of training.

The Net Attempts chart, which combines both speed and accuracy by subtracting errors from total attempts, revealed the most comprehensive improvement in the experimental group. Their net attempts increased from 39.85 to 58.15, reflecting substantial gains in both efficiency and correctness. Conversely, the control group displayed a decrease from 33.95 to 32.35, reinforcing that no improvement occurred naturally.

Taken together, these three variables provide strong visual and statistical evidence that the intervention effectively enhanced the experimental group's cognitive performance. The consistent upward trend in total and net attempts, combined with the reduction in wrong attempts, confirms that the intervention improved both speed and accuracy, leading to overall better task performance. In contrast, the control group's stagnant or declining results validate that these positive changes were a direct outcome of the intervention rather than external or incidental factors.

Variables	Group	Pre (M ± SD)	Post (M ± SD)	Df	t value	p value
Trial making test (time) A	Experimental group	36.55 ± 9.08	23.35 ± 6.86	19	4.879	0.000
Trial making test (time) A	Control group	34.500 ± 9.82	34.95 ± 9.52	19	-0.418	0.681

Table 2 Comparison of Trial Making test (Time)A (Pre and Post) Scores for Experimental and Control Groups

Variables	Group	Pre (M ± SD)	Post (M ± SD)	Df	t value	p value
Trial Making Test (time) B	Experimental group	89.150 ± 39.85	56.05 ± 14.55	19	3.316	0.004
Trial Making Test (time) B	Control group	77.11 ± 21.05	81.750 ± 20.08	19	-3.134	0.005

Table 3 Comparison of Trial making test(Time)\ B (Pre and Post) Scores for Experimental and Control Groups

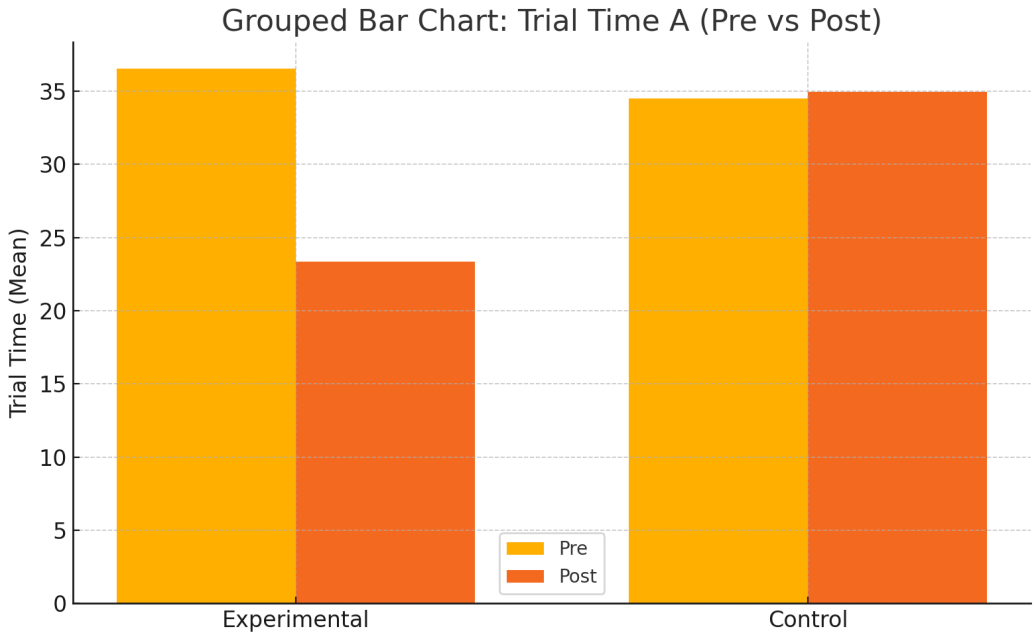

Figure 4 Grouped Bar Chart representing Trial Making test(Time)A (Pre vs Post) for Experimental and Control Groups

Alt text: Grouped bar chart comparing pre-test and post-test completion time for Trail Making Test A between experimental and control groups

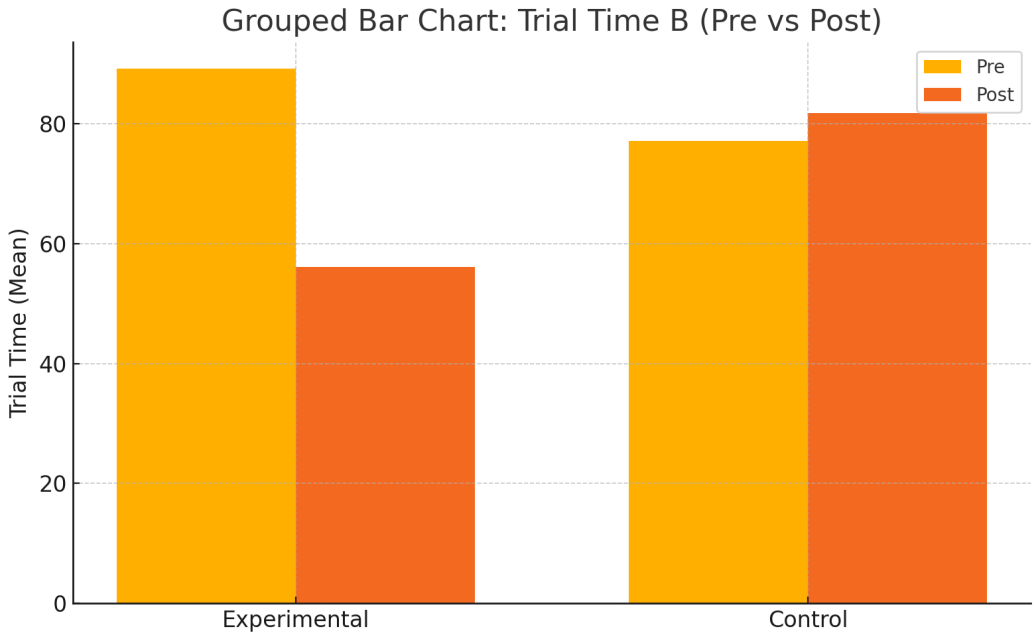

Figure 5 Grouped Bar Chart representing Trial Time B (Pre vs Post) for Experimental and Control Groups

Alt text: Grouped bar chart comparing pre-test and post-test completion time for Trail Making Test B between experimental and control groups

Combined Interpretation of Trial Time A and Trial Time B Bar Charts

The combined interpretation of the bar charts for Trial Time A and Trial Time B reveals a consistent pattern demonstrating the effectiveness of the intervention for the experimental group. In both charts, the experimental

group exhibited a significant reduction in trial time from pre-test to post-test, indicating notable improvement in task efficiency, psychomotor speed, and overall performance.

For Trial Time A, the experimental group's mean time decreased from 36.55 to 23.35, reflecting faster completion speed after the intervention. Similarly, in Trial Time B, their performance improved substantially, with time reducing from 89.15 to 56.05. These consistent reductions across both trials suggest that the intervention enhanced participants' reaction time, coordination, and ability to complete tasks quickly and efficiently.

In contrast, the control group showed no improvement in either trial. For Trial Time A, their scores remained nearly unchanged (34.50 to 34.95), indicating no natural progress without intervention. More notably, in Trial Time B, their trial time increased from 77.11 to 81.75, showing a decline in performance, which may be attributed to fatigue, lack of stimulation, or absence of structured training.

The statistical results support these visual trends. Both Trial Time A and Trial Time B produced significant t-values with $p < 0.05$ for the experimental group, confirming that the reduction in trial time is statistically meaningful. Meanwhile, the control group showed non-significant or negative changes, reinforcing the lack of improvement.

Overall, the combined results from both charts confirm that the intervention had a positive and significant impact. It consistently improved the experimental group's ability to perform tasks faster, while the control group did not experience similar gains. These findings collectively highlight the strong effectiveness of the intervention in enhancing psychomotor performance and processing speed.

4.1 Descriptive Summary

Before the intervention, participants in the experimental group exhibited higher attention scores, indicating lower levels of focused attention and a greater degree of distractibility. The mean pre-test score was 36.55 ± 9.08. After completing the structured attention training program, the same participants demonstrated a significant reduction in attention scores, with the mean post-test score decreasing to 23.36 ± 6.86.

A decrease in score reflects improved attention, enhanced mental steadiness, and greater cognitive efficiency.

4.2 Comparison Between Pre-Test and Post-Test Performance

The reduction in mean scores suggests a robust improvement in several aspects of attentional functioning, including:

sustained focus

reduced impulsive shifting of attention

higher resistance to distractions

improved accuracy in task performance

better mental processing speed

The paired comparison clearly indicates that participants who underwent the focused attention training demonstrated enhanced alertness and greater cognitive control compared to their baseline levels.

4.3 Statistical Significance of Change

Inferential analysis using the paired t-test confirmed that the difference between the pre-test and post-test mean scores was statistically significant at the 0.05 level. This indicates that the improvement in attention did not occur by chance but was a direct result of the intervention.

Given the substantial effect size implied by the large difference between the two means, the training program appears to have had a meaningful and practical impact on cognitive performance.

4.4 Interpretation of Outcomes

The significant decline in attention scores following the intervention reflects the effectiveness of focused attention practices in enhancing cognitive alertness. Participants demonstrated:

higher mental stability

greater consistency in task performance

better ability to concentrate on a single target

decreased interference from external and internal distractions

These shifts suggest that the training successfully strengthened the attentional system, leading to measurable improvements in cognitive efficiency.

4.5 Summary of Key Findings

Attention significantly improved in the experimental group after the intervention.

Mean scores decreased by more than 13 points, demonstrating a strong practical effect of the training.

The change was statistically significant, confirming the reliability of the results.

Improvements reflect enhanced attention control, sustained focus, and reduced distractibility.

In summary, the focused attention training program produced a clear and meaningful enhancement in cognitive alertness among university students, validating its potential as an effective cognitive training tool.

5. Discussion

The present study set out to explore the impact of a structured focused attention training module on cognitive alertness among university students. The results clearly demonstrated a significant improvement in attention scores following the intervention. The observed change is consistent with existing theoretical frameworks and supports the argument that attention is not a static trait but a modifiable cognitive skill that can be enhanced through systematic training.

5.1 Positioning Within Existing Trataka Literature

Previous experimental evidence has reported beneficial cognitive outcomes following Trataka. Raghavendra and Singh (2016) observed improved Stroop performance after an immediate Trataka session compared with a control condition. Talwadkar et al. (2014) reported improvements in selected cognitive functions in older adults following Trataka training. Swathi et al. (2021) reported improvements in working/spatial memory and spatial attention following a two-week Trataka-related training protocol. A randomized study among adolescents also reported improved cognitive performance following yogic visual concentration (Sherlee & David, 2020). The present study extends this literature by examining an eight-week controlled pre–post program in university students and by using both a letter-cancellation task and TMT-A/B. Because the present analysis is primarily within-group, however, the findings should be viewed as supportive rather than definitive evidence of a between-group causal effect.

5.2 Cognitive Interpretation of the Outcomes

The SLCT findings are compatible with improved efficiency on a visual search and attention-demanding task, while the reductions in TMT-A and TMT-B completion time indicate faster performance on tasks involving visuo-perceptual tracking/processing speed and, for TMT-B, divided attention and cognitive flexibility. These interpretations describe the functions represented by the tests; they do not establish that the intervention changed any specific underlying cognitive mechanism.

5.3 Possible Mechanisms-Interpreted Cautiously

Focused visual practice may require repeated maintenance of attention on a selected stimulus and disengagement from competing stimuli. Such repeated task demands could plausibly contribute to improved performance on attention measures. However, the present study did not include EEG, neuro-imaging, autonomic measures, or other direct physiological indicators. Therefore, statements about enhanced neural coordination, activation of specific executive-control brain regions, altered autonomic activity, or specific neuro-physiological pathways are not warranted from the present data and have been removed.

5.4 Interpretation of Findings

The substantial improvement in post-test attention scores suggests that the intervention was highly effective in stabilizing mental focus and improving the students' ability to process information efficiently. Practices like Trataka and breath awareness cultivate internal steadiness, reduce cognitive fragmentation, and strengthen the capacity to hold attention on a single target for longer durations. These psychological shifts align with classical descriptions of attention training found in yogic literature.

Trataka in particular is known to reduce visual distractions, enhance neural coordination between ocular and frontal-cortical regions, and promote deeper sensory withdrawal. Breath awareness complements this by reducing sympathetic arousal, calming the mind, and sharpening internal attention filters. Together, these components contribute to significantly improved performance on attention-based tasks.

5.5 Cognitive Mechanisms Behind the Improvement

Several cognitive and neuropsychological mechanisms explain the observed improvement:

Enhanced Stimulus Filtering

Focused attention training helps individuals filter irrelevant information more effectively. This strengthens selective attention - an essential cognitive function for academic activities such as reading, reasoning, and problem-solving.

Strengthening of Executive Function

Practices like Trataka activate brain regions responsible for executive control, decision-making, and sustained attention. Improved executive functioning directly enhances task engagement and reduces mental fatigue.

Reduction in Cognitive Load

The breath awareness component of the intervention reduces internal cognitive chatter, allowing the brain to allocate more resources to attentional tasks.

Improved Mind–Body Synchronization

Attention-training practices regulate physiological markers associated with stress and distraction, resulting in a relaxed yet alert mental state conducive to better concentration.

5.6 Relevance in the Modern Academic Context

Today's students face an unprecedented level of cognitive overload due to constant exposure to digital devices, multitasking demands, and academic pressure. These factors cumulatively erode attention span and impair cognitive performance. The findings of this study thus hold strong real-world implications: integrating simple, low-cost attention training exercises into the academic routine can significantly buffer against attention decline.

5.7 Implications for Mental Health and Academic Performance

Higher attention levels correlate strongly with improved academic achievement, better working memory, emotional regulation, and reduced stress. (Kapas et al., 2025) By strengthening attention, students may become more efficient in:

time management

examination performance (Dhananjoy Debnath et al., 2024)

information retention

task prioritization

Furthermore, practicing Trataka and breath awareness has been shown in previous studies to reduce symptoms of anxiety and mental restlessness, making this training module beneficial beyond cognitive enhancement. (Kusuma et al., 2021)

5.8 Strengths and Limitations

One strength of the study is the use of a direct pre–post comparison supported by a control group, providing a clear picture of intervention-related effects. However, the study is limited by its small sample size and single-institution setting. Future research could expand the sample, include long-term follow-ups, and compare different types of attention-training methods. (Chhugani et al., 2017)

5.8.1 Implications

Trataka is a relatively simple practice that can be delivered with limited equipment and may be feasible in educational settings. The present results suggest that further investigation of structured Trataka practice in university populations is warranted. However, claims regarding improved academic achievement, productivity, mental health, or reduced stress should not be inferred from this study because those outcomes were not directly measured.

5.8.2 Strengths and Limitations

Strengths include a controlled pre–post design, a defined eight-week intervention period, 48 planned sessions, use of more than one behavioural attention measure, and reporting of standardized within-group effect sizes. Important limitations include the small sample (20 participants per group), lack of a documented a priori power calculation, purposive recruitment, absence of a documented pre-specified primary-outcome hierarchy, reliance on paired within-group analyses rather than a baseline-adjusted between-group model, lack of direct neuro-

physiological measures, and lack of systematic measurement of time-varying factors that might influence performance. Although no dropouts were reported, adherence was not quantified with a formal session-by-session compliance metric in the available study record. These limitations mean that the findings should be interpreted cautiously and should not be presented as definitive evidence of a causal treatment effect.

5.9 Future Directions

Future studies should use an a priori power calculation, clearly prespecified primary outcomes, documented allocation procedures, objective adherence monitoring, and direct between-group analyses such as ANCOVA adjusting for baseline performance or a Group × Time model when appropriate. Longer follow-up periods and direct measures of potential mediators, including EEG or other validated physiological measures, could help test - not merely assume - possible mechanisms.

Potential future studies could explore:

Neuro-physiological measures (EEG, HRV) to correlate attention changes with brain activity

Longitudinal effects of consistent attention training over months

Comparative studies across different age groups or professions

Integration of digital tools (apps, VR) with traditional practices

6. Conclusion

An eight-week Trataka-based practice was associated with significant within-group improvements in several behavioural measures of attention and processing efficiency among university students. Experimental-group performance improved on SLCT total and net attempts and on TMT-A and TMT-B completion time, whereas wrong attempts did not change significantly. The significant deterioration in control-group TMT-B was an unexpected finding for which a specific cause could not be established. Overall, the results support further controlled investigation of Trataka as a potential attention-training practice, while the absence of a formal power analysis and direct baseline-adjusted between-group testing requires cautious interpretation of the observed effects.

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