

Guided Visualization Meditation as a Cognitive-Enhancement Strategy in Medical Education: A Controlled Study of Visual and Auditory Reaction Time

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Abstract

Background: High screen exposure is common among young adults and may coexist with attentional fatigue, sleep disruption, perceived stress, and altered psychomotor responsiveness. Brief guided attention practices are low-cost and easy to implement, but their immediate effect on simple sensory reaction time in high-screen-time young adults remains incompletely characterized.

Methods: A prospective controlled pretest-post-test study was conducted at a tertiary care hospital from March 2024 to June 2025. Fifty young adults were studied with 25 assigned to guided visualization and 25 to equal-duration quiet sitting. VRT and ART were recorded before and immediately after the intervention, with 10 trials for each modality. Heart rate, systolic and diastolic blood pressure, and perceived stress score were secondary outcomes. Between-group changes were compared using two-sided Mann-Whitney U tests because of non-normal change-score distributions and unequal group dispersions.

Results: Mean VRT decreased from 290.80 ± 13.36 to 254.92 ± 12.40 ms after guided visualization and from 293.64 ± 13.26 to 287.60 ± 13.29 ms in controls. Median VRT reduction was 36.00 (35.00–37.00) ms versus 6.00 (5.80–6.20) ms ($U=0$, $p<0.001$). Mean ART decreased from 280.64 ± 12.77 to 242.80 ± 9.29 ms and from 283.16 ± 12.65 to 277.20 ± 12.64 ms, respectively; median ART reduction was 38.00 (34.00–41.00) ms versus 5.90 (5.80–6.20) ms ($U=0$, $p<0.001$). Secondary physiological and perceived stress outcomes also showed larger immediate reductions after guided visualization (all Holm-adjusted $p<0.001$).

Conclusion: A single 10-minute guided visualization session was associated with substantially faster immediate visual and auditory responses than quiet sitting in this cohort of high-screen-time young adults. These findings support further evaluation of brief guided visualization as an attentional reset strategy, with larger studies incorporating documented allocation procedures, objective screen-time verification, trial-level reaction-time data, and longer follow-up.

Keywords: psychomotor performance; digital exposure; attentional regulation; guided imagery; meditation; young adults, visual reaction time, auditory reaction time.

Introduction

Digital media use has become inseparable from education, communication, and recreation, particularly among young adults. In India, problematic smartphone use is increasingly recognised among undergraduate medical students, while international evidence links greater smartphone involvement with poorer sleep and other behavioral consequences.[1,2] The concern is not screen duration in isolation. Prolonged digital engagement may occur alongside visual fatigue, fragmented attention, shortened sleep, and higher perceived stress, each of which can influence psychomotor performance.

Reaction time provides a compact measure of sensory detection, central processing, attention, and motor execution. Recent Indian observations are particularly relevant. Higher screen exposure has been associated with prolonged choice reaction time among medical college students,[3] and another study in young medical students reported differences in visual and auditory reaction time in relation to smartphone use.[4] Such studies are predominantly observational; they do not establish that screen exposure alone causes slower responses. They do, however, provide a reasonable basis for examining brief strategies that may restore attentional readiness during periods of sustained digital activity.

Mindfulness and related attentional practices have attracted interest because they require little equipment and can be delivered in short sessions. A systematic review and meta-analysis found a small overall cognitive benefit following brief mindful-attention induction, with substantial heterogeneity across tasks and studies.[5] Experimental work in meditation-naïve adults has demonstrated improvements in attentional performance after brief practice,[6] while a single 10-minute mindfulness session has been associated with acute improvement in selected cognitive measures.[7] A 10-minute duration has also been shown to alter state mindfulness and affective experience, supporting the feasibility of brief interventions.[8]

Guided visualization is related but not identical to breath-focused mindfulness. It combines settling, attentional anchoring, and structured mental imagery, potentially engaging sustained attention while reducing competing cognitive load. Whether a brief guided visualization session can acutely influence simple visual and auditory reaction time in young adults already exposed to several hours of daily screen use remains insufficiently studied. The present study therefore compared the immediate effects of a standardized 10-minute guided visualization session with an equal-duration quiet-sitting condition on VRT and ART. Concurrent changes in heart rate, blood pressure, and perceived stress score were examined as secondary outcomes.

Materials and Methods

Study design and setting

This prospective, parallel-group controlled pretest-posttest study was conducted at a tertiary care hospital from March 2024 to June 2025. The study evaluated an acute 10-minute guided visualization meditation condition against an equal-duration quiet-sitting control condition. The primary outcomes were immediate changes in VRT and ART.

Study population

Young adults aged 18-25 years with high daily screen exposure were eligible. High screen exposure was defined as at least 4 hours of average daily screen use. Participants were required to be apparently healthy, have normal or corrected-to-normal vision and functional hearing, be able to understand the intervention instructions, and provide written informed consent. The analysed sample comprised 50 participants, 25 in each study condition.

Exclusion criteria

Participants with known neurological disease, major psychiatric illness, significant visual or hearing impairment, conditions affecting upper-limb motor response, current use of medication likely to materially alter central nervous system performance, acute illness, or established regular meditation practice were excluded.

Screen-time assessment

Average daily screen time was recorded in hours for each participant and used to confirm eligibility. Device-level application logs or smartphone Digital Wellbeing/Screen Time exports were not available in the analytical record; therefore, screen exposure was analysed as the recorded daily-duration measure without assuming objective device verification.

Group allocation and study conditions

The final study record comprised two equal groups of 25 participants. The allocation sequence and any concealment procedure were not documented in the available study record. Accordingly, the study is reported as a controlled pretest-posttest investigation and no claim of random assignment is made.

Baseline assessment

Age, sex, daily screen time, VRT, ART, heart rate, systolic blood pressure, diastolic blood pressure, and perceived stress score were recorded before exposure to the assigned 10-minute condition. Testing was undertaken under consistent laboratory conditions, with the same measurement approach used before and after the study condition.

Reaction-time assessment

Visual and auditory reaction times were assessed using the same standardized computer-based reaction-time setup at baseline and immediately after the study condition. Ten trials were documented for VRT and 10 for ART at each assessment. Participant-level reaction-time values were expressed in milliseconds, with lower values indicating faster responses. Trial-level observations were not available in the final analytical record; therefore, no unsupported assumption was made regarding exclusion of familiarization trials or the exact algorithm used to derive the participant-level summary value.

Guided visualization intervention

Participants in the intervention group completed a standardized 10-minute guided visualization session. The session incorporated an initial settling phase, calm breath awareness, guided visualization of a peaceful environment using visual, auditory, and bodily imagery, sustained attention to the imagined scene, and gradual re-orientation to the testing environment. Post-condition measurements were obtained immediately after completion.

Control condition

Control participants sat quietly for the same 10-minute duration without guided imagery, deliberate meditation instruction, music, or a cognitive task. They then underwent the same immediate post-condition VRT, ART, cardiovascular, and perceived stress assessments. The equal-duration comparator was intended to account for simple rest and passage of time.

Outcome measures

The primary outcomes were changes in VRT and ART from baseline to the immediate post-condition assessment. Secondary outcomes were changes in heart rate, systolic blood pressure, diastolic blood pressure, and perceived stress score. Change was calculated as baseline minus post-condition value, so a larger positive VRT or ART change represented a greater improvement in reaction speed.

Ethical considerations

The study was conducted after approval from the Institutional Ethics Committee of Mahatma Gandhi Medical College and Research Institute and in accordance with applicable institutional ethical requirements and the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants before study procedures. Confidentiality and anonymity were maintained during analysis and reporting.

Statistical analysis

Continuous variables were summarised as mean $\pm$ standard deviation (SD). Change scores were additionally reported as median with interquartile range (IQR). Categorical variables were presented as frequency and percentage. Baseline continuous variables were compared descriptively using Welch independent-samples t tests and sex distribution using Fisher exact test. Distributional assumptions for change scores were examined using the Shapiro-Wilk test and between-group dispersion using the median-centred Levene test. Because normality and/or equal-dispersion assumptions were not satisfied for several outcomes, two-sided Mann-Whitney U tests were used for participant-level change scores, with the smaller U statistic reported. VRT and ART were treated as co-primary outcomes; both remained significant at a conservative two-sided alpha of 0.025. Secondary outcome p-values were adjusted for multiplicity using the Holm procedure. Analyses were performed using Python 3.13 with SciPy and statsmodels.

Results

Participant profile and baseline characteristics

All 50 participants had complete baseline and immediate post-condition measurements and were included in the analysis, with 25 participants in each group (Figure 1). Overall age ranged from 19 to 24 years. The guided visualization group had a mean age of 21.44 ± 1.58 and the control group 21.36 ± 1.66 . Each group included 13 males (52.0%) and 12 females (48.0%). Mean daily screen time was 6.39 ± 0.96 and 6.44 ± 0.92 , respectively. No statistically significant baseline difference was identified for age, screen time, VRT, ART, heart rate, blood pressure, perceived stress score, or sex distribution (Table 1).

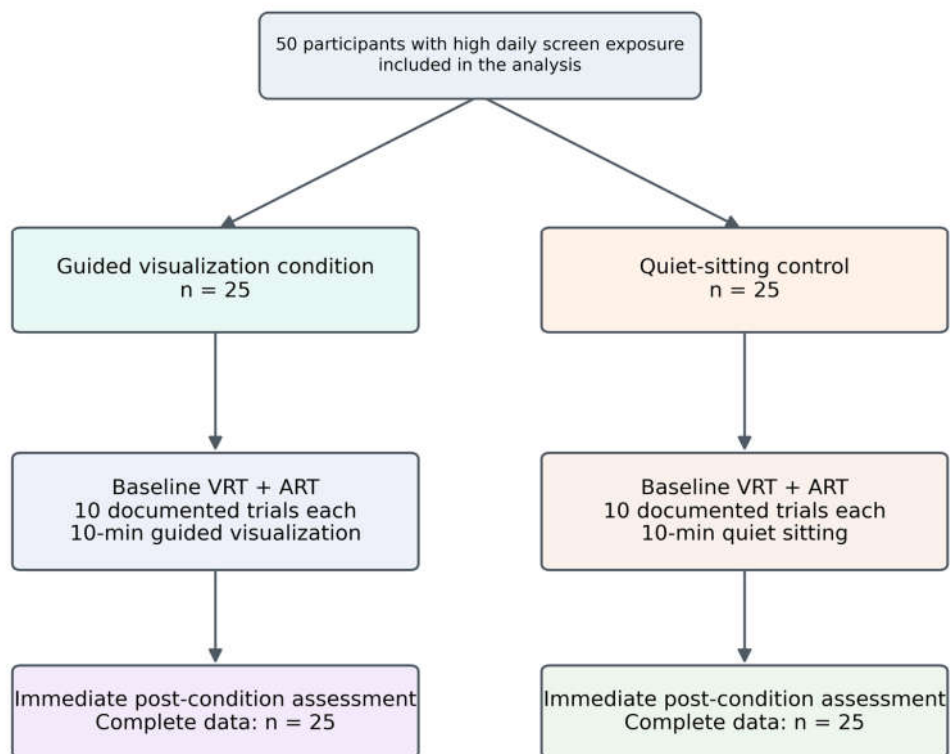


Figure 1. Study flow and completion of pretest-posttest assessments.

VRT: visual reaction time; ART: auditory reaction time.

Table 1. Baseline characteristics of the study groups (n=50).

Characteristic	Guided visualization (n=25)	Quiet-sitting control (n=25)	p-value
Age (years)	21.44±1.58	21.36±1.66	0.862
Male sex, n (%)	13 (52.0)	13 (52.0)	1.000
Daily screen time (h)	6.39±0.96	6.44±0.92	0.857
Baseline VRT (ms)	290.80±13.36	293.64±13.26	0.454
Baseline ART (ms)	280.64±12.77	283.16±12.65	0.487
Heart rate (bpm)	78.96±3.09	79.80±3.30	0.358
Systolic BP (mmHg)	122.44±4.37	123.40±5.05	0.476
Diastolic BP (mmHg)	78.68±3.09	79.40±3.34	0.433
Perceived stress score	19.04±3.16	19.80±3.35	0.413

Values are mean±SD unless otherwise stated. Baseline p-values are descriptive. Continuous variables were compared using Welch independent-samples t tests; sex distribution was compared using Fisher exact test. VRT: visual reaction time; ART: auditory reaction time; BP: blood pressure.

Primary outcomes: visual and auditory reaction time

Mean VRT decreased from 290.80±13.36 to 254.92±12.40 ms after guided visualization and from 293.64±13.26 to 287.60±13.29 ms after quiet sitting. Median VRT reduction was 36.00 (35.00-37.00) ms in the visualization group compared with 6.00 (5.80-6.20) ms in controls. The between-group distribution of VRT change differed significantly (Mann-Whitney U=0, p<0.001), with a Hodges-Lehmann median between-group difference in improvement of 30.1 ms (Table 2, Figure 2).

ART showed the same directional separation. Mean ART decreased from 280.64±12.77 to 242.80±9.29 ms in the guided visualization group and from 283.16±12.65 to 277.20±12.64 ms in the control group. Median ART reduction was 38.00 (34.00-41.00) ms versus 5.90 (5.80-6.20) ms, respectively (U=0, p<0.001). The Hodges-Lehmann median between-group difference in ART improvement was 32.1 ms. Mean absolute improvement is summarised in Figure 4.

Table 2. Primary reaction-time outcomes before and after 10-minute study condition by Mann-Whitney test.

Outcome	Group	Baseline, mean±SD	Post, mean±SD	Reduction, median (IQR)	p value
VRT (ms)	Guided visualization	290.80±13.36	254.92±12.40	36.00 (35.00-37.00)	<0.001
	Quiet-sitting control	293.64±13.26	287.60±13.29	6.00 (5.80-6.20)	Reference
ART (ms)	Guided visualization	280.64±12.77	242.80±9.29	38.00 (34.00-41.00)	<0.001
	Quiet-sitting control	283.16±12.65	277.20±12.64	5.90 (5.80-6.20)	Reference

Reduction = baseline minus post-condition value. U is the smaller Mann-Whitney statistic from the between-group comparison of participant-level change scores. VRT: visual reaction time; ART: auditory reaction time; IQR: interquartile range.

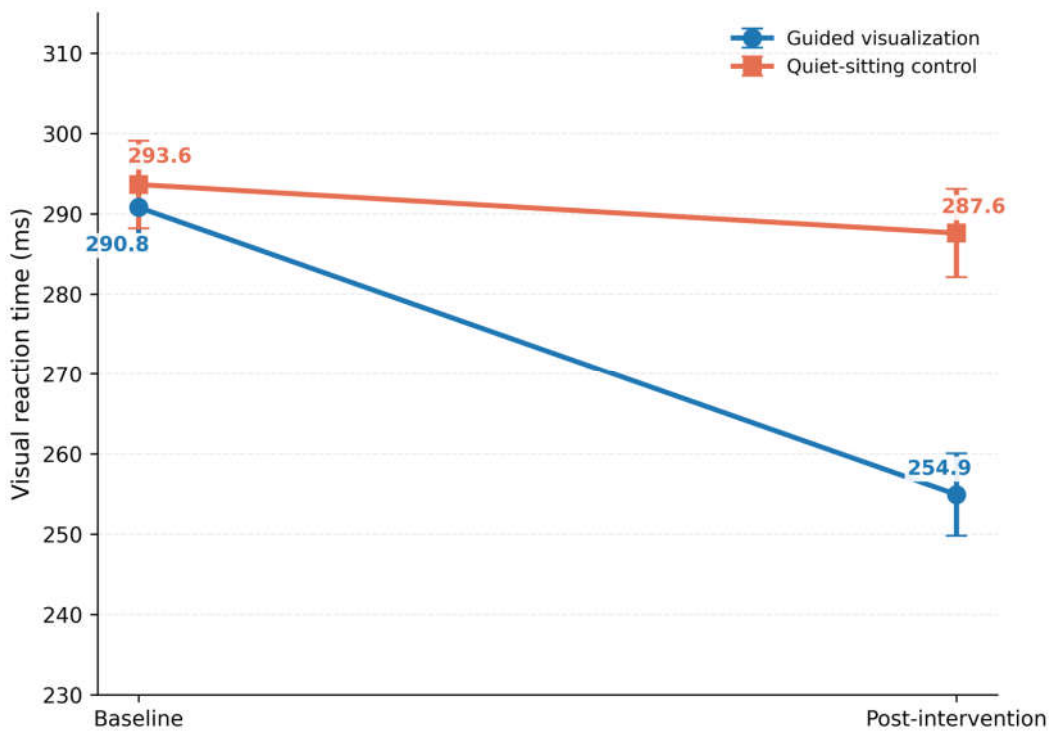


Figure 2. Baseline and immediate post-intervention visual reaction time by study group.

Points represent group means; error bars represent 95% confidence intervals of the group means. Lower values indicate faster responses.

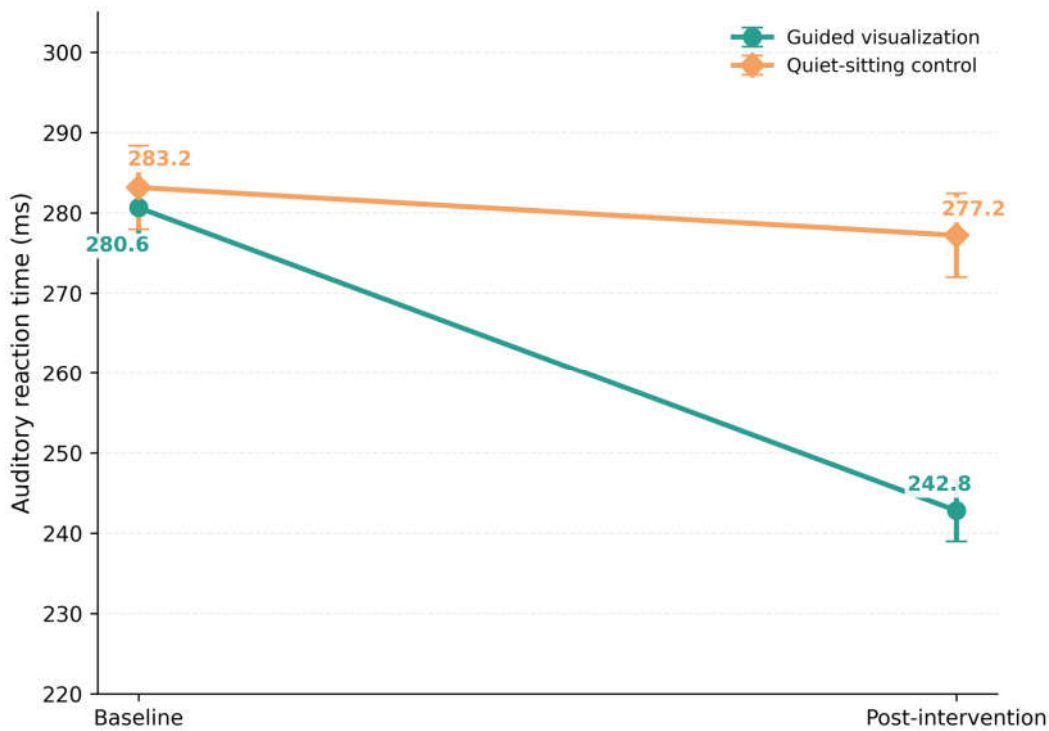


Figure 3. Baseline and immediate post-intervention auditory reaction time by study group.

Points represent group means; error bars represent 95% confidence intervals of the group means. Lower values indicate faster responses.

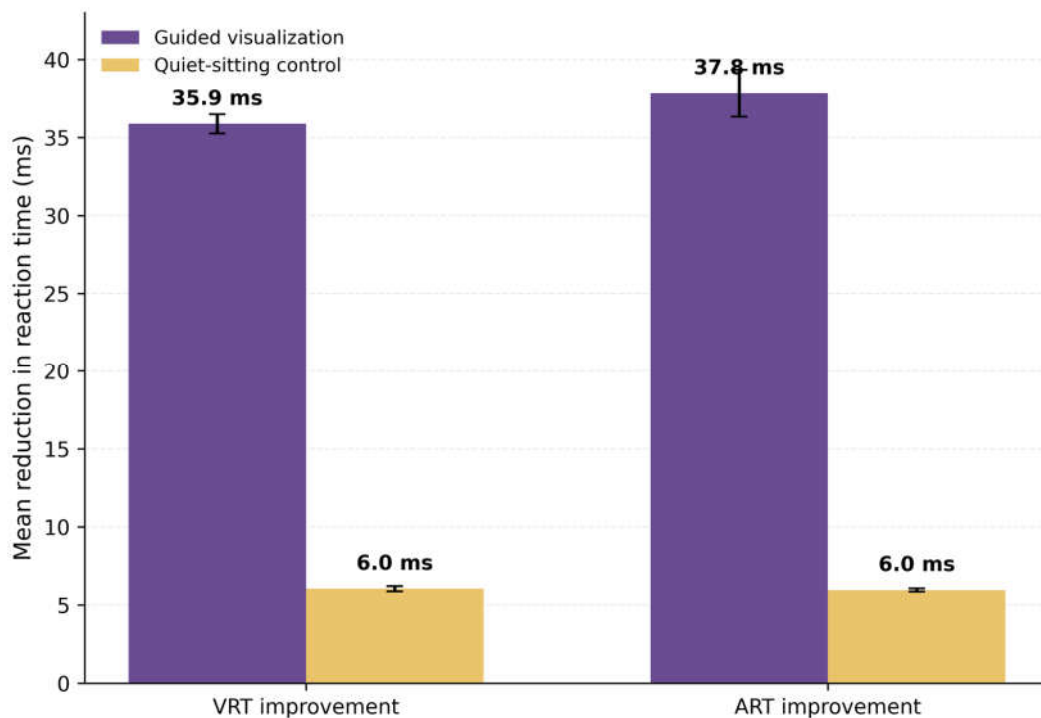


Figure 4. Mean absolute improvement in visual and auditory reaction time.

Values above bars show the descriptive mean reduction from baseline. Error bars represent 95% confidence intervals of the mean change; inferential comparisons used Mann-Whitney U tests on participant-level change scores.

Secondary physiological and perceived stress outcomes

The secondary outcomes also showed larger immediate reductions after guided visualization (Table 3). Median heart-rate reduction was 8.00 (8.00-8.00) bpm versus 0.90 (0.70-1.30) bpm; systolic blood-pressure reduction was 6.00 (4.00-6.00) versus 2.00 (1.40-2.70) mmHg; and diastolic blood-pressure reduction was 6.00 (6.00-6.00) versus 2.00 (1.40-2.60) mmHg. Perceived stress score decreased by a median of 7.00 (6.00-8.00) points after guided visualization compared with 1.00 (0.60-1.50) points in controls. For each secondary outcome, $U=0$ and Holm-adjusted $p<0.001$. The perceived stress trajectory is shown in Figure 5, and relative cardiovascular changes are summarised in Figure 6.

Table 3. Secondary physiological and perceived stress outcomes.

Outcome	Group	Baseline, mean $\pm$ SD	Post, mean $\pm$ SD	Reduction, median (IQR)	U; Holm-adjusted p
Heart rate (bpm)	Guided visualization	78.96 $\pm$ 3.09	71.12 $\pm$ 3.03	8.00 (8.00-8.00)	0; <0.001
	Quiet-sitting control	79.80 $\pm$ 3.30	78.80 $\pm$ 3.62	0.90 (0.70-1.30)	Reference
Systolic BP (mmHg)	Guided visualization	122.44 $\pm$ 4.37	117.28 $\pm$ 3.55	6.00 (4.00-6.00)	0; <0.001
	Quiet-sitting control	123.40 $\pm$ 5.05	121.40 $\pm$ 5.68	2.00 (1.40-2.70)	Reference
Diastolic BP (mmHg)	Guided visualization	78.68 $\pm$ 3.09	72.84 $\pm$ 3.05	6.00 (6.00-6.00)	0; <0.001
	Quiet-sitting control	79.40 $\pm$ 3.34	77.50 $\pm$ 3.89	2.00 (1.40-2.60)	Reference
Perceived stress score	Guided visualization	19.04 $\pm$ 3.16	12.00 $\pm$ 2.35	7.00 (6.00-8.00)	0; <0.001
	Quiet-sitting control	19.80 $\pm$ 3.35	18.80 $\pm$ 3.12	1.00 (0.60-1.50)	Reference

Reduction = baseline minus post-condition value. Secondary analyses were exploratory and Holm-adjusted for four comparisons. BP: blood pressure; IQR: interquartile range.

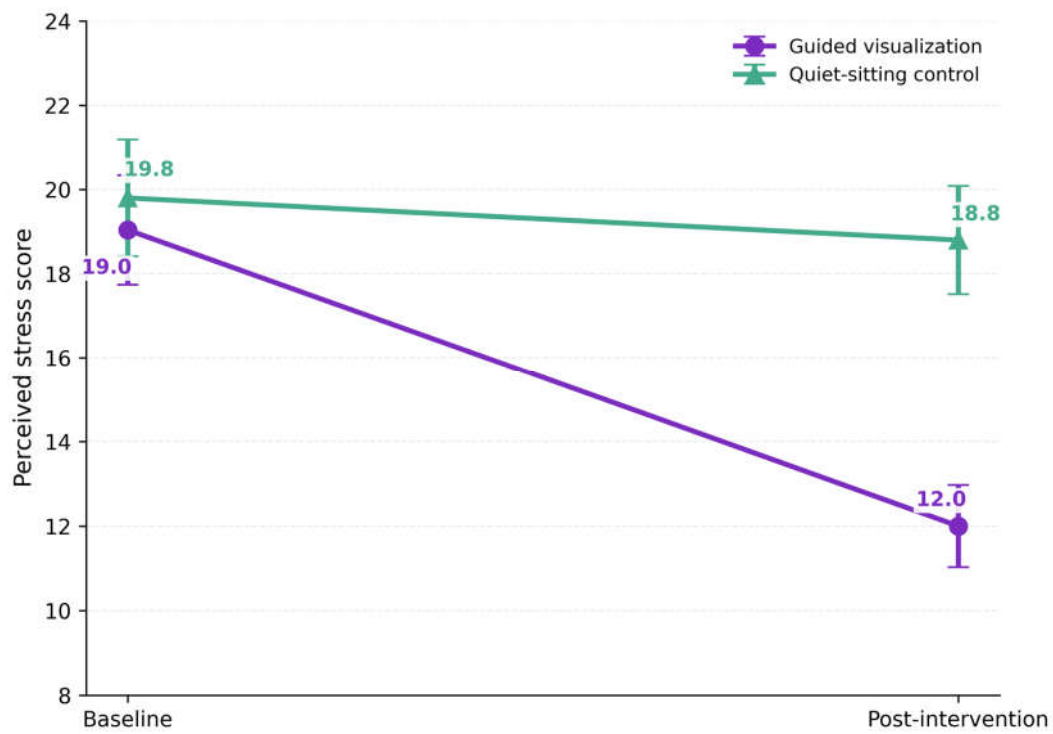


Figure 5. Change in perceived stress score following the 10-minute study condition.

Points represent group means; error bars represent 95% confidence intervals of the group means.

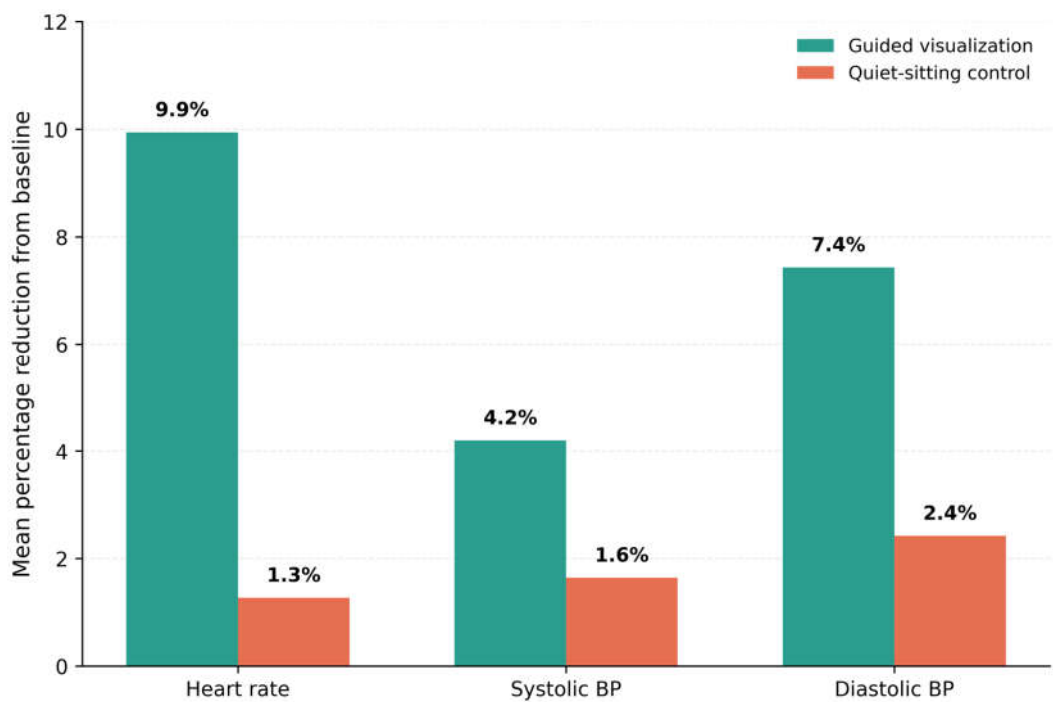


Figure 6. Mean percentage reduction in cardiovascular measures after the study condition.

Values above bars show descriptive mean within-participant percentage reduction from baseline. BP: blood pressure.

Discussion

The principal finding of this study was a pronounced immediate improvement in both sensory reaction-time modalities following a single 10-minute guided visualization session. Median visual reaction time (VRT) improved by 36.00 (35.00-37.00) ms in the visualization group compared with 6.00 (5.80-6.20) ms after quiet sitting. Auditory reaction time (ART) showed a comparable pattern, with median reductions of 38.00 (34.00-41.00) and 5.90 (5.80-6.20) ms, respectively. The separation between the two change-score distributions was complete for both primary outcomes in this sample, and the rank-based comparisons remained highly significant. The practical interpretation is therefore not merely that reaction time improved after a period of rest, because a small improvement also occurred in controls, but that the magnitude of improvement was substantially greater after guided visualization.

The modest reduction in VRT and ART observed in the quiet-sitting group is itself informative. Repeated reaction-time testing can produce familiarization, anticipation, and practice effects, particularly when the pre- and post-assessments are separated by only a brief interval. An equal-duration control condition therefore strengthens the comparison by capturing some of this non-specific improvement. At the same time, the present data should not be interpreted as evidence that guided visualization permanently accelerates neural conduction or psychomotor function. The measurements represent an acute state immediately after the intervention. They are more appropriately viewed as an index of short-term sensorimotor readiness, attentional engagement, and response efficiency under the standardized testing conditions used in this study.

The direction of the findings is consistent with experimental work on brief meditation. Edwards and Loprinzi reported improvement in selected reaction-time measures after acute meditation-related conditions,[9] while Kaul et al. observed an immediate improvement in psychomotor vigilance after meditation in novice meditators.[10] Longer mind-body training has also been associated with shorter visual and auditory reaction times in Indian student volunteers,[11] providing a locally relevant physiological comparison despite the much longer training exposure. A single 10-minute mindfulness session has been associated with faster Stroop performance,[7] and even brief practice can produce detectable changes in state mindfulness and affect.[8] These studies used cognitive tasks and meditation procedures that were not identical to the present protocol, so direct numerical comparison would be inappropriate. Still, taken together, they support the plausibility that a short period of deliberate attentional regulation can alter performance during an immediately subsequent cognitive or psychomotor task.

The high-screen-time population is also relevant to interpretation. The participants in both groups reported roughly six hours of daily screen exposure, placing them within a pattern increasingly encountered in university and professional training environments. Indian data have linked greater screen exposure with prolonged choice reaction time,[3] and visual and auditory reaction time have been reported to worsen after smartphone engagement in medical students.[4] More recent work in medical students has additionally associated heavier electronic-media use with lower academic performance, altered fluid cognitive performance, and less efficient neurophysiological indices of attention.[17] Among Indian medical and nursing students, screen exposure has also shown a strong relationship with poorer sleep quality, although attention-span findings have not been uniformly consistent.[18] Experimental evidence that even the mere presence of a smartphone may reduce basal attentional performance further illustrates how digital environments can compete for limited cognitive resources.[19] Similarly, studies using Stroop paradigms in students with problematic smartphone use suggest alterations in cognitive control under conflict conditions.[20]

These observations should not be overstated. The present study did not include a low-screen-time comparison group, and therefore it cannot determine whether the baseline VRT or ART values were abnormal because of screen exposure. Screen time is also an imprecise proxy for digital load. Academic reading, video

lectures, gaming, social media, messaging, and passive video viewing differ in attentional demand, emotional salience, viewing distance, and time of day. Ocular discomfort may be one additional pathway through which prolonged screen use affects task performance. A systematic review of young screen users found higher digital-eye-strain symptoms with prolonged screen exposure,[21] while Indian university studies have similarly identified daily screen duration as a determinant of digital eye strain.[22,23] Broader systematic evidence also shows that problematic smartphone use in university populations is shaped by psychological and behavioural factors rather than by duration alone.[24] Future work should therefore separate recreational and academic exposure, verify use through device logs, and record sleep, visual symptoms, and the timing of the last digital exposure before testing.

From a cognitive perspective, the visualization exercise may have functioned as a brief period of attentional stabilization. Earlier work by Zeidan et al. showed that only four days of brief mindfulness training improved visuospatial processing, working memory, and executive functioning compared with an active control condition.[25] Tang et al. likewise demonstrated better attentional control and stress regulation after short-term integrative body-mind training.[26] Reviews of neuropsychological outcomes suggest that early stages of mindfulness practice, which emphasize maintaining attention on a selected object and redirecting attention after distraction, may be particularly relevant to selective and executive attention.[27] Yet meta-analytic evidence is heterogeneous, and group-based mindfulness programs do not produce uniformly robust improvements across every executive domain.[28] This distinction is important. The present study assessed simple sensory reaction time, not complex executive function, memory, intelligence, or academic achievement. Faster VRT and ART should therefore be interpreted within their own psychomotor domain rather than generalized to a global cognitive enhancement.

A mechanistic explanation can be framed around attentional-resource allocation rather than a single anatomical pathway. Malinowski proposed that mindfulness practice may improve the efficiency with which attentional resources are allocated during early information processing.[29] Functional neuroimaging synthesis of focused-attention meditation has implicated coordinated activity across default-mode, salience, and executive-control networks, including prefrontal, cingulate, and insular regions.[30] Reviews of mindfulness-related attentional control also emphasize reduced mind-wandering and improved regulation of task-relevant attention, while acknowledging that well-powered causal studies remain necessary.[31] The conceptual distinction between focused-attention and open-monitoring meditation is relevant here, because the intervention in this study contained an explicit attentional anchor and structured imagery rather than unrestricted monitoring of experience.[32] A short-term reduction in internally competing thoughts, combined with sustained imagery and breath awareness, could therefore reduce response variability or improve readiness for the next stimulus. Neurophysiological testing would be needed to establish whether that explanation is correct.

Guided visualization should also be distinguished from mindfulness meditation as a generic category. The present intervention deliberately incorporated a peaceful imagined environment with visual, auditory, and bodily cues. This may recruit imagery-related sensory representation in addition to the attentional mechanisms shared with other contemplative practices. Zemla et al. reported that guided imagery can influence stress-related responses, brain function, and attention,[12] while longer programmes involving guided imagery or meditation have been associated with reductions in perceived chronic stress among college students.[15] The current findings extend that literature by suggesting that a very brief visualization session may be followed by measurable changes in simple visual and auditory response speed. Because no breath-only or imagery-free meditation arm was included, however, the study cannot identify which component of the 10-minute sequence was responsible for the observed effect.

The secondary physiological findings were directionally coherent with an acute relaxation response. Heart rate, systolic blood pressure, and diastolic blood pressure decreased more in the guided-visualization group than in controls. Slow breathing has previously been shown to influence arterial baroreflex function and blood pressure,[13] and a systematic review of voluntary slow breathing describes convergent autonomic, central nervous system, and subjective relaxation effects, including increased heart-rate variability and parasympathetic modulation.[33] The present protocol included calm natural breathing but did not standardize respiratory frequency, measure respiration continuously, or record heart-rate variability. Consequently, the cardiovascular changes cannot be assigned specifically to vagal activation, baroreflex modulation, or slowed respiration. They are better treated as supportive evidence that the intervention altered the participant's immediate physiological state.

Perceived stress scores also declined more after guided visualization. This direction accords with evidence that brief mindfulness practice can reduce momentary subjective stress,[14] and with longer college-based imagery or meditation programmes showing reductions in chronic stress.[15] Meta-analytic evidence in healthy adults suggests that mindfulness-based stress reduction can reduce stress, anxiety, and psychological distress, although effect sizes vary substantially between studies.[34] Broader systematic review evidence likewise supports small-to-moderate benefits of meditation programmes for several dimensions of psychological stress while emphasizing limitations in study quality and active-control comparisons.[35] In nonclinical settings, mindfulness-based programmes appear to improve some mental-health outcomes relative to no intervention, but effects are heterogeneous and may not exceed those of other structured activities.[36] These caveats are particularly relevant here because the Perceived Stress Scale was originally designed to assess global appraisal of stress over a broader period rather than a minute-to-minute state.[16] Its immediate pre-post change should therefore be considered an exploratory indicator of subjective relaxation, not evidence that chronic stress was reduced within 10 minutes.

The parallel movement in reaction time, cardiovascular measures, and perceived stress raises an interesting possibility: the effect may represent a coordinated shift from a distracted or physiologically activated state toward a calmer but attentive state. This would be consistent with the intended structure of guided visualization, which combines attentional narrowing, reduced engagement with external digital stimuli, and internal imagery. Importantly, calmness does not necessarily imply reduced alertness. In the present sample, reaction time became faster despite lower heart rate and blood pressure. That pattern is compatible with improved efficiency rather than simple sedation, although subjective sleepiness and objective vigilance were not measured and should be included in future protocols.

The findings have practical relevance to Indian medical and university environments, where digital platforms are now integral to lectures, clinical learning, examination preparation, communication, and recreation. A standardized 10-minute guided visualization recording is inexpensive, requires no specialized equipment, and could be delivered before prolonged study sessions or after sustained digital work. Its potential advantage is feasibility rather than proof of superiority over established digital-health measures. Adequate sleep, scheduled screen breaks, appropriate viewing distance, ergonomic correction, and moderation of non-essential screen exposure remain more fundamental strategies. Guided visualization may eventually serve as an adjunctive attentional reset, but the present study does not establish effects on examination performance, clinical decision-making, driving, procedural skills, or long-term cognitive health.

Finally, the magnitude and consistency of the observed immediate reaction-time advantage warrant replication rather than promotional interpretation. Contemporary mindfulness science has repeatedly emphasized the need for precise intervention definitions, credible control conditions, prospective protocols, objective adherence measures, and avoidance of claims that extend beyond the measured outcome.[37] Future

studies should therefore use prospectively documented random allocation, concealed assignment where feasible, blinded outcome assessment, automated trial-level reaction-time exports, and preregistered primary analyses. A three-arm design comparing guided visualization, breath-focused meditation, and an expectancy-matched control would help separate imagery-specific effects from general relaxation and repeated-testing effects. Follow-up measurements at 30 minutes, several hours, and after repeated daily practice would clarify duration and dose-response. Within those boundaries, the current data provide a coherent preliminary signal that brief guided visualization is associated with an immediate improvement in simple visual and auditory response speed among young adults with substantial daily screen exposure.

Strength

Strengths include an equal-duration concurrent control condition, balanced group sizes, complete participant-level data for the reported outcomes, assessment of both visual and auditory reaction time, and a consistent immediate pre-post design. The updated control data contain within-group variation rather than zero-variance change scores, allowing a more credible description of the comparator response. Rank-based inference was nevertheless retained because several change-score distributions were non-normal and dispersion differed between groups.

Limitations

Several limitations constrain interpretation. This was a single-centre study with a modest sample and only an immediate post-condition assessment. The allocation sequence and concealment procedure were not available for verification, so randomization cannot be claimed and residual selection bias is possible. Screen exposure was available as a daily-duration measure but lacked device-log verification. The analytical record contained participant-level reaction-time summaries and trial counts rather than trial-by-trial observations, preventing assessment of intra-individual variability, lapses, learning across trials, and the handling of familiarization trials. Outcome assessment was not documented as blinded. The control change distributions remained narrower than those of the visualization group, particularly for reaction time, although they were no longer invariant. Finally, the specific perceived-stress instrument/version and its suitability for immediate state change were not documented. These considerations support cautious interpretation and independent replication.

Conclusion

In this controlled pretest-posttest study of young adults with high daily screen exposure, a single 10-minute guided visualization meditation session was associated with substantially larger immediate improvements in visual and auditory reaction time than an equal period of quiet sitting. Parallel reductions were observed in heart rate, blood pressure, and the recorded perceived stress score. The findings are encouraging for the use of brief guided visualization as an attentional reset strategy, but they should be confirmed in larger prospectively designed studies with documented allocation procedures, objective screen-time verification, trial-level reaction-time recording, validated state-stress measurement, and longer follow-up.

Declarations

Ethical approval: Approval was obtained from the Institutional Ethics Committee before commencement of participant-related procedures. Written informed consent was obtained from all participants. Participant confidentiality was maintained throughout analysis and reporting.

Source of Funding: Nil.

Conflict of Interest: Authors declare there is no conflict of interest.

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