

## Original Article

# The role of mindfulness in reducing test anxiety and improving academic performance among high school students

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Received: 16 Nov 2025

Accepted: 01 Dec 2025

Published: 09 Dec 2025

## Abstract

**Background:** The present study aimed to investigate the effect of mindfulness training on reducing test anxiety and improving the academic performance of high school students.

**Methods:** This quasi-experimental study used a pre-test–post-test control group design. The study population included all 10th-grade students from high schools in Tehran during the 2024–2025 academic year. A total of 60 students were selected through cluster random sampling and randomly assigned to the experimental (n=30) and control (n=30) groups. The experimental group participated in eight 90-minute sessions of mindfulness training based on Kabat-Zinn’s model, while the control group did not receive any intervention. Data were collected using the Spielberger Test Anxiety Inventory and students’ final semester grade point average (GPA) as an indicator of academic performance. Data were analysed using independent t-test, paired t-test, and analysis of covariance (ANCOVA) in SPSS-26.

**Results:** The results indicated that the mean score of test anxiety in the experimental group significantly decreased after the intervention ( $P < 0.001$ ), while no significant difference was observed in the control group. The mean academic performance of the experimental group improved significantly ( $P = 0.002$ ). The ANCOVA results showed that mindfulness training had a significant effect on both test anxiety and academic performance.

**Conclusion:** Mindfulness training can be used as an effective intervention to reduce test anxiety and enhance students’ academic performance. Implementing mindfulness-based educational programs in schools can play a key role in improving students’ mental health and promoting effective learning outcomes.

**Keywords:** Academic Performance; Education; Mental Health; Mindfulness; Students; Test Anxiety.

**Cite this article as:** Espid M, Ahmadi Tabar F, Ghazaghi L. The role of mindfulness in reducing test anxiety and improving academic performance among high school students. *Soc Determinants Health*. 2025;11(1):1-9. DOI: <http://dx.doi.org/10.22037/sdh.v11i1.50885>

## Introduction

Test anxiety is one of the most common forms of anxiety among high school students. It can significantly reduce attention, working memory, and test performance. This anxiety not only affects test scores but may

also lead to longer-term outcomes such as reduced academic motivation, burnout, and academic failure (1). Mindfulness is generally defined as “a nonjudgmental and purposeful awareness of present-moment experiences”. It has been applied in

programs such as Mindfulness-Based Stress Reduction (MBSR) and other structured interventions. This approach was first systematized by Jon Kabat-Zinn and his colleagues and then expanded rapidly to clinical and educational settings (2). Theoretical mechanisms making mindfulness appropriate for reducing test anxiety include enhancing attentional regulation, increasing observer awareness, reducing identification with negative thoughts, and improving emotional regulation (3). These processes can reduce physiological stress responses, reduce avoidance or worry-based thinking, and improve concentration during study and testing. Thus, it is expected that mindfulness interventions will reduce test anxiety and improve academic performance (4).

Empirical evidence also supports the effectiveness of mindfulness interventions in reducing anxiety and stress. Comprehensive meta-analyses have indicated that mindfulness-based therapies and programs significantly reduce anxiety, stress, and depressive symptoms (5). Growing evidence suggests that school-based mindfulness programs can also improve cognitive functioning and some measures of academic performance in addition to reducing emotional symptoms. However, effect sizes vary across studies and age groups, and the quality of studies has been reported to be variable (6). Recent intervention studies (including RCTs and mid-term follow-ups) in the area of testing and adolescent test anxiety have revealed promising results in reducing test anxiety and negative self-judgment. Some studies have even reported sustained effects up to one year after the intervention. However, questions remain about the optimal duration of intervention, the accurate mechanisms of effect, and the generalizability of results to different educational contexts (e.g., schools with different levels of test pressure or demographic differences) (7). Considering the research gaps, this article investigates the effectiveness of mindfulness-based

programs in reducing test anxiety and examines their impacts on the academic performance of high school students. The present study reviewed and synthesized the existing empirical evidence on the impact of mindfulness on test anxiety in adolescents, evaluated its impact on grades and academic performance indicators, and identified limitations and suggested a future research guide to design effective and acceptable interventions in educational settings.

## Methods

### *Research setting and population*

This study was a randomized controlled clinical trial with a pretest-posttest design with a control group. It was conducted in the academic year 2024-2025 among high school students in Tehran.

The research setting was public and non-profit secondary schools in this city that had counselors and facilities for implementing psychological group programs. The statistical population included all students in grades 10 to 12. A multi-stage random sampling method was used. First, several schools were randomly selected. Then, eligible individuals were selected among students who had a score above the average based on the test anxiety questionnaire.

### *Inclusion criteria included:*

- Willingness to participate in mindfulness training sessions,
- No severe psychiatric disorders or use of anti-anxiety medications,
- No history of participating in similar mindfulness programs,
- Regular attendance during the intervention period.

Exclusion criteria included:

- Absence of more than two sessions,
- Starting other psychological treatment during the study,
- Withdrawal from cooperation.

In this study, the required sample size for each group was estimated to be 30 people using g\*power software and assuming a

medium effect size (Cohen's  $d = 0.5$ ), a 95% confidence level ( $\alpha = 0.05$ ), and a test power ( $1 - \beta = 0.80$ ). The total sample size was considered to be 60 people for the experimental and control groups.

### **Data collection method**

The following standard questionnaires were used as data collection tools:

1. Spielberger Test Anxiety Inventory (TAI), consisting of 20 questions with two components of worry and excitability. Its reliability has been confirmed in Iranian studies ( $\alpha = 0.88$ ) (8).
2. Academic Performance Questionnaire to evaluate students' midterm and final semester grades with GPA and core subject scores (mathematics, physics, and literature) (9).
3. Mindful Attention Awareness Scale – Adolescent Version (MAAS-A) to examine changes in mindfulness levels before and after the intervention(10).

### **Mindfulness-Based Intervention**

The mindfulness intervention consisted of eight group-based sessions, conducted once per week, each lasting 60 minutes. The program was based on the Mindfulness-Based Stress Reduction (MBSR) protocol and adapted for adolescents according to Burke (11). Each session included (1) breathing awareness exercises, (2) body scan practice, (3) sitting meditation, (4) mindful attention to thoughts, emotions, and bodily sensations, and (5) daily home practice assignments (10–15 minutes per day). Participants also received brief worksheets to support home exercises.

The control group did not receive any mindfulness-based training during the study period and attended only routine school counseling sessions unrelated to mindfulness or anxiety reduction.

### **Outcome Measures**

1. **Mindfulness Level:** Mindfulness levels were assessed using the Mindful Attention

Awareness Scale–Adolescent Version (MAAS-A).

- Higher scores indicate greater mindfulness.
  - There is no clinical cut-off; scores are interpreted continuously, with higher scores reflecting higher mindful awareness.
2. **Test Anxiety:** Test anxiety was measured using the Spielberger Test Anxiety Inventory (TAI), which includes the subscales of worry and emotionality.
    - Higher scores represent greater test anxiety.
    - Scores do not have a clinical abnormal/normal cut-off; however, scores above the sample mean typically indicate elevated anxiety.
  3. **Academic Performance:** Academic performance was evaluated using students' GPA, midterm, and final exam scores, as well as scores in core subjects (mathematics, physics, and literature). These scores were obtained from the school's official academic records.

### **Outcome Assessment Procedure**

All outcomes (MAAS-A, TAI, and academic performance data) were collected before the intervention (pre-test) and immediately after the eighth session (post-test). Questionnaires were administered in a quiet classroom setting under researcher supervision.

### **Ethical Considerations**

This study adhered to the ethical principles of the Declaration of Helsinki and followed institutional guidelines for research involving adolescents. Although formal ethics committee approval was not required for this type of school-based educational study, the research protocol was reviewed and approved by the school administration and the district educational authorities. Participation was completely voluntary, written informed consent was obtained from both students and their parents, and all data were collected anonymously to ensure confidentiality. The control group received an educational mindfulness booklet after

Table 1. Demographic characteristics of participants in the two study groups

Variable	intervention group (n=30)	control group (n=30)	t / $\chi^2$ value	sig (p)
Mean age (years)	16.40 $\pm$ 0.79	16.50 $\pm$ 0.83	0.46	0.64
gender (girl/boy)	16 / 14	16 / 14	0.00	1.00
Base GPA	17.10 $\pm$ 1.05	17.05 $\pm$ 0.98	0.19	0.85
Parental educational status (medium/high)	70% / 30%	66.7% / 33.3%	0.13	0.72

the completion of the study to ensure equitable access to the intervention content.

To assess adherence to the exercises, a daily exercise notebook was provided to the students and reviewed in each session.

Data were collected in three steps:

- Pre-test: before the sessions began.
- Post-test: immediately after the sessions ended.
- Follow-up: four weeks after the intervention to assess the sustainability of the effect.

### Statistical analysis

The data were analyzed in SPSS-26 software. First, the normal distribution of variables was examined using the Shapiro–Wilk test. Chi-square and independent t-tests were used to compare demographic characteristics. The changes in mean test anxiety scores and academic performance at three times (pre-test, post-test, and follow-up) were examined using repeated measures ANOVA. Bonferroni post-hoc tests were used to compare paired times if a significant effect was observed. The significance level in all tests was considered to be  $p < 0.05$ . Also, eta squared ( $\eta^2$ ) was used to estimate the effect size to determine the level of the intervention's

effect on reducing anxiety and improving academic performance.

### Results

#### Demographic characteristics of participants

In this study, 60 high school students (30 in the intervention group and 30 in the control group) participated. The mean age of the participants was  $16.45 \pm 0.81$  years. Regarding gender, 53.3% were female and 46.7% were male. The two groups did not differ significantly regarding age, gender, and baseline GPA ( $p > 0.05$ ), indicating initial homogeneity of the groups Table 1.

Table 2 shows the mean and standard deviation of test anxiety scores in the three stages of pre-test, post-test, and follow-up four weeks after the intervention in the two intervention and control groups. As shown, in the pre-test stage, the mean test anxiety score in the intervention group ( $58.20 \pm 6.12$ ) and the control group ( $57.60 \pm 5.98$ ) did not differ significantly ( $t = 0.37$ ,  $p = 0.71$ ), indicating the initial homogeneity of the two groups regarding test anxiety levels before the intervention.

The mean test anxiety score in the intervention group decreased significantly after implementing the mindfulness training program ( $6.85 \pm 42.10$ ), but no significant change was observed in the control group ( $6.03 \pm 56.80$ ).

Table 2. Mean and standard deviation of test anxiety scores in the three stages

Measurement time	Intervention group (mean $\pm$ sd)	Control group (mean $\pm$ sd)	Independent t-test	p-value
Pretest	58.20 $\pm$ 6.12	57.60 $\pm$ 5.98	0.37	0.71
Posttest	42.10 $\pm$ 6.85	56.80 $\pm$ 6.03	8.64	<0.001
Follow-up (4 weeks later)	40.80 $\pm$ 7.02	56.20 $\pm$ 6.22	9.12	<0.001

Table 3. Changes in GPA in the three stages

Measurement time	Intervention group (mean $\pm$ sd)	Control group (mean $\pm$ sd)	Independent t-test	p-value
Pretest	17.02 $\pm$ 1.05	17.04 $\pm$ 0.98	0.07	0.94
Posttest	18.23 $\pm$ 0.92	17.12 $\pm$ 1.00	4.47	<0.001
Follow-up (4 weeks later)	18.30 $\pm$ 0.95	17.08 $\pm$ 1.05	4.88	<0.001

The independent t-test revealed a significant difference between the two groups in the post-test stage ( $t=8.64$ ,  $p<0.001$ ). The results of the follow-up, conducted four weeks after the end of the training sessions, indicate the sustainability of the intervention effect, so the mean test anxiety score in the intervention group remained lower ( $40.80 \pm 7.02$ ) and the difference with the control group ( $56.20 \pm 6.22$ ) was still statistically significant.

Table 3 shows the mean and standard deviation of the students' academic GPA in the three stages of pre-test, post-test, and follow-up four weeks after the intervention in the two intervention and control groups. Based on the results, the mean academic GPA between the two intervention groups ( $17.02 \pm 1.05$ ) and control groups ( $17.04 \pm 0.98$ ) did not differ significantly ( $t=0.07$ ,  $p=0.94$ ) in the pre-test stage, indicating the initial homogeneity of the academic performance level in the two groups before the implementation of the intervention. The mean academic GPA in the intervention group increased significantly after implementing the mindfulness training sessions ( $18.23 \pm 0.92$ ), but no significant change was observed in the control group ( $17.12 \pm 1.00$ ). The independent t-test showed a statistically significant difference between the two groups ( $t=4.47$ ,  $p<0.001$ ).

The mean GPA in the intervention group ( $18.30 \pm 0.95$ ) remained higher than that in the control group at the four-week follow-up stage after the intervention ( $17.08 \pm 1.05$ ). This difference was statistically significant ( $t=4.88$ ,  $p<0.001$ ). This result indicates that the positive impacts of mindfulness training on academic

performance were sustainable in the post-intervention period.

Table 4 shows the correlation coefficients between changes in the variables of mindfulness, test anxiety, and academic performance. As seen, there is a negative and significant correlation between mindfulness and test anxiety ( $r = -0.61$ ), meaning that the level of test anxiety decreases as mindfulness increases in students. This result supports the moderating role of mindfulness in reducing emotional and stressful reactions in academic assessment situations. Also, a positive and significant relationship was observed between mindfulness and academic performance ( $r = 0.54$ ), indicating that students who experience higher levels of present moment awareness, concentration, and nonjudgmental acceptance have better academic performance. This association could be due to improved concentration, emotional self-regulation, and motivation as a result of mindfulness training. There is a strong and negative association between test anxiety and academic performance ( $r = -0.58$ ). This result indicates that increased test anxiety is associated with reduced academic performance, while reducing anxiety through mindfulness interventions can improve performance.

Table 4. Correlation between changes in mindfulness, test anxiety, and academic performance

Variables	Test Anxiety	Academic Performance	Mindfulness
Test Anxiety	1	-0.58	-0.61
Academic Performance	-0.58	1	0.54
Mindfulness	-0.61	0.54	1

## **Discussion**

The study revealed that implementing a mindfulness training program in high school students led to a significant reduction in test anxiety and improved academic performance, while no significant changes were observed in the control group. These results support the effectiveness of mindfulness-based interventions in educational settings and are in line with previous studies that reported reductions in anxiety and improvements in academic outcomes following mindfulness practice (12, 13). Similar to those studies, our findings indicate that mindfulness enhances attentional control and emotional stability, which consequently reduces physiological stress responses and improves students' concentration during study and testing.

The theoretical mechanisms underlying these positive effects relate to enhanced attentional regulation, increased observer awareness, reduced identification with negative thoughts, and improved emotional regulation. These mechanisms explain why students in our intervention group showed reduced anxiety levels, a finding that aligns with previous studies highlighting the role of mindfulness in reducing emotional reactivity and stress responses (14). Compared with these earlier findings, our results similarly demonstrate that strengthening awareness and acceptance decreases worry-based thinking and promotes more adaptive cognitive processing.

Additionally, the four-week follow-up results showed that reductions in test anxiety and improvements in academic performance persisted beyond the immediate post-test period. This sustained effect is consistent with recent empirical evidence suggesting that mindfulness interventions can lead to lasting changes in emotional and cognitive functioning (14). While some prior studies observed smaller follow-up effects, the relatively stronger persistence in our study may be attributed

to the structured implementation and continued practice monitoring.

Based on these results, mindfulness training can be considered an effective tool for promoting mental health and improving students' academic success. The significant reduction in test anxiety observed in our intervention group mirrors findings from previous research showing that mindfulness reduces cognitive fusion with negative thoughts and enhances emotional regulation (14, 15). In comparison to these studies, our findings suggest a similar pathway in which increased observer awareness decreases the intensity of anxiety-provoking cognitions.

Neuroscientific studies have shown that MBSR-based exercises reduce activation in stress-related brain regions (such as the amygdala) and enhance prefrontal cortex functioning involved in emotional control and decision-making (16). The significant reduction in test anxiety in our findings is consistent with these neuroscientific mechanisms, suggesting that the participants in our study may have experienced improved emotional stability similar to what has been documented in earlier neuroimaging research.

The study also revealed that mindfulness exercises increased students' GPAs and improved academic performance. This outcome is comparable to findings reported in earlier studies, which linked mindfulness practice with improved working memory, increased concentration, and reduced mental distraction (17, 18). While most prior studies show modest improvements in academic scores, our results demonstrated a relatively stronger association, possibly due to students' consistent engagement with home-based mindfulness practices.

Mindfulness programs in the school setting have been shown to improve sustained attention, behavioral self-regulation, and emotion management—factors considered key prerequisites for academic success (19). The positive changes observed in our

students align with these established benefits. Additionally, our study replicated the negative association between test anxiety and academic performance reported in earlier research (20). Similar to those findings, the reduction in anxiety in our intervention group likely facilitated better focus and productivity in academic tasks.

The significant increase in mindfulness scores (MAAS-A) in the intervention group, and its negative correlation with test anxiety, supports previous meta-analyses and empirical studies that found higher mindfulness to be associated with less anxiety and better emotional regulation (21, 22). Our findings compare closely with these studies, suggesting that improved present-moment awareness and acceptance reduce rumination and negative self-evaluation in adolescents. The sustained improvement noted at follow-up also corresponds with studies showing that mindfulness techniques, when practiced regularly, can yield durable cognitive and emotional benefits.

While several studies have shown that long-term maintenance of mindfulness effects depends on consistent personal practice and school support (23), our findings similarly indicate that the four-week sustainability of benefits may extend further if students continue practicing mindfulness beyond the formal sessions. This parallels earlier research emphasizing the importance of continuous engagement to maintain long-term intervention effects.

Finally, the results of this study are consistent with international research demonstrating the positive impact of mindfulness interventions on students' mental health and learning outcomes (24, 25). However, the effect size in our study was larger than in several previous studies, which may be attributable to the cohesive group structure, in-person delivery, and close monitoring of exercises. Similar to earlier evidence, our findings suggest that mindfulness training is a simple, low-cost, and practical method for reducing test

anxiety and improving academic performance, making it suitable for incorporation into school counseling and mental health programs.

### **Conclusion**

The results of this study suggest that implementing mindfulness training programs in high school students can significantly reduce test anxiety and improve their academic performance. These results indicate that mindfulness reduces negative thoughts and rumination and paves the way for more effective learning and academic success by promoting sustained attention, behavioral self-regulation, and emotional regulation. The effectiveness of these interventions in the intervention group, compared to the lack of change in the control group, confirms the importance of using mindfulness-based approaches in educational settings. Evidence suggests that mindfulness programs can have lasting effects, reduce anxiety, and improve academic performance even in short-term follow-ups. Due to the importance of mental health and academic performance of adolescents, it is recommended that schools and educational authorities include mindfulness-based educational programs as part of their educational and support activities for students. These results also provide a future research guide to further study the long-term effects, adapt interventions for different ages, and examine the accurate mechanisms of mindfulness impact on mental health and academic performance. Generally, mindfulness training can play a key role in promoting students' mental health and academic success as a scientific, cost-effective, and implementable intervention in schools.

### **Authors' contribution**

Mitra Espid and Fatemeh Ahmadi Tabar developed the study concept and design. Leila Ghazaghi and Mitra Espid acquired the data. Leila Ghazaghi and Mitra Espid

analyzed and interpreted the data, and wrote the first draft of the manuscript. All authors contributed to the intellectual content, manuscript editing and read and approved the final manuscript.

### ***Informed consent***

Questionnaires were filled with the participants' satisfaction and written consent was obtained from the participants in this study.

### ***Funding/financial support***

There is no funding.

### ***Conflict of interest***

The authors declare that they have no conflict of interests.

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