

## Effect of Mindfulness Meditation on Test Anxiety Phenomena among University Nursing Students

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### Abstract

Test anxiety is a universal phenomenon affecting students at all levels. Efforts are needed to help students get and use coping strategies to alleviate such anxiety. The study aim was to investigate the effects of two specific types of meditation, namely Vipassana and Shamatha techniques, on test anxiety among nursing students. This **open-label randomized trial** was conducted at the Faculty of Nursing, Beni-Suef University. It included 200 undergraduate Nursing students randomized into two intervention groups. **Four tools of data collection** were used in this study: (1)A self-administered questionnaire with the (2) Revised Test Anxiety Scale (TA), (3) the Automatic Thoughts Questionnaire-Positive (ATQ-P) (4) and the Positive and Negative Affect Schedule (PANAS) was used for data collection. The students in each group received the study intervention in small groups over one-month. **The main results showed that** the students in both groups had high pre-intervention scores of TA, with medians of 3.0 or higher, low scores of (ATQ-P), and high PANAS negative were low PANAS positive scores. The interventions led to significant decreases in TA and negative PANAS scores, with increases in ATQ-P and PANAS positive scores in the two groups ( $p < 0.001$ ). The multivariate analysis identified the use of meditation technique as the main negative predictor of the TA and PANAS -ve score, and a main positive predictor of the ATQ-P and PANAS +ve scores. **Conclusion:** Shamatha technique had a better effect on TA score. Vipassana or Shamatha meditation techniques can alleviate nursing students. The techniques are easily taught and are acceptable by students. **Study recommended that,** Boost students' competence to manage stress and anxiety by using mindfulness meditation techniques and developing interventions that can provide students with support as they fight with a test anxiety problem.

**Keywords:** Mindfulness meditation, Vipassana, Shamatha, Test anxiety, Nursing students

### Introduction

Test anxiety is a universal phenomenon affecting students at all levels and worldwide due to the challenges and stressors met in academic settings, which add to the difficulties they have at their late adolescence age to adjust to transition to adulthood. Most students experience it regardless of their extent of preparation for the exam (*Duraku and Hoxha, 2018*). Although a low level of test anxiety preceding exams may be beneficial in increasing students' alertness and attention, high levels can have negative impacts on their test performance (*Ferreira et al., 2020; Mojarrab et al., 2020*).

Moreover, students may experience negative automatic thoughts along with their test anxiety that may have further negative impacts on them. Negative automatic thoughts refer to the cognitive errors arising in one's mind that would lead to depressive symptoms (*Al-Omari and Abu Khait, 2023*). Automatic thoughts may have a direct effect on depression, and is mediated by anxiety (*Demi et al., 2022*).

Efforts are needed to help students get and used coping strategies to alleviate such anxiety (*Parrish, 2022*). Many approaches have been used to reduce students' test anxiety, with variable levels of

success. For instance, a meta-analysis investigated the effectiveness of the use of aromatherapy in reducing college students' test anxiety. Although the results showed effectiveness in reducing test anxiety, no difference could be found between aromatherapy and placebo control groups. It was concluded that more research is needed (*Luan et al., 2023*). Similarly, the use of lemon essential oil proved to be effective in the alleviation of test anxiety among nursing students by 43.3% (*Özer et al., 2022*).

In another approach, *Walker (2023)* demonstrated the effectiveness of therapy dog intervention in reducing nursing students' test anxiety. It also had a positive impact on students' positive affect using the positive affect negative affect schedule (PANAS) (*Peel et al., 2023*). Furthermore, *Abbasi et al. (2023)* found that the use of simulated video is effective in reducing test anxiety in nursing and midwifery students.

The use of Eastern old traditional therapies could also help. Meditation therapies are healing practices used in traditional medicine in the East as a part of the religio-spiritual-healing traditions. These practices are increasingly being used in mainstream medicine worldwide (*Zahir, 2022*). Certain types of such meditation practices enhance a person's cognitive states, with more sympathetic activation and focused attention. Others as Shamatha, a technique of calm meditation, and Vipassana are based on fostering parasympathetic activity with more calmness and alertness with a boost of focused attention (*Kozhevnikov, 2019*). These are known as "Stillness Meditation" that are based on absence of thoughts, perceptions, and mental images, i.e., "contentless one's experiences" (*Woods et al., 2020*). Vipassana, a simple technique aimed to achieve peace of mind and to lead a useful life, has been reported as the most frequently practiced of these meditation techniques (*Gamma and Metzinger, 2021*).

For instance, the effectiveness of the educational interventions using cognitive emotion and mindfulness strategies students' test anxiety and psychological wellbeing revealed significant reduction in students' test anxiety in addition to improvement of their psychological wellbeing and mental health promotion (*Noroozi and Mohebbi-Dehnavi, 2022*). A similar finding was also reported from a quasi-experimental using a cognitive-behavioral intervention, with successful alleviation of nursing students' test anxiety (*Parrish, 2022*). However, no study investigated the effectiveness of such techniques in the alleviation of test anxiety and their applicability among Egyptian students.

### Significance of the study:

Test anxiety is common among students, with deleterious effects on their physical and mental health as well as their test performance. Several approaches will be used to manage such disorder, with varying outcomes. Two approaches often used are Vipassana and Shamatha techniques. The merits of these two approaches are seldom compared, especially when administered as group therapy. However, no study investigated the effectiveness of mindfulness meditation namely Shamatha and Vipassana to alleviation of test anxiety and their applicability among Egyptian students.

### Aim of the Study

The study aims to investigate the effects of two specific types of meditation, namely Vipassana and Shamatha techniques on test anxiety among university nursing study.

### Research hypothesis:

This study hypothesized that:

- H1-** Nursing students' test anxiety receiving vipassana technique will be significantly improved after practicing Vipassana technique.

**H2-** Nursing students' test anxiety receiving Shamatha technique will have better effect comparison with those receiving vipassana techniques.

## Subjects & Methods

### Research design:

An open-label randomized trial design was utilized in this study since the intervention by nature could not be masked by participants or researchers. However, to compensate for the potential bias of the open-label design, blinding was applied during the processes of data collection and analysis.

### Setting:

The study was conducted at the Faculty of Nursing, Beni-Suef University at Beni-Suef. It is the largest university in Egypt in terms of the number of colleges and institutes. It has (33) colleges and institutes, including a number of unique and distinguished colleges not only at the level of Egyptian Universities, but at the level of the Middle East. Beni-Suef Faculty of Nursing is attracting elite faculty members and utilizes advanced educational programs to prepare students for their future professional careers in various Nursing disciplines, including Psychiatric Nursing and Mental Health. Its goal is to meet local and regional health sector labor market needs, provide scientific research, meet current and future societal requirements, and maintain quality standards.

### Subjects:

The study population consisted of all undergraduate Bachelor of Science in Nursing students enrolled in the faculty during the academic year 2023-24. Their numbers are 600 in grade 1, 550 in grade 2, 530 in grade 3, and 500 in grade 4. To be eligible for inclusion in the study sample, the student should not be under psychological or psychiatric treatment, using psychotropic drugs, or having a history of

neurological disease. Those having attended a similar previous training were also excluded. The selected participants signed an informed consent form, and the research protocol was approved by the University Ethics Committee.

### Sample type:

The required sample size was calculated to demonstrate improvements in the post-intervention mean scores of test anxiety, ATQ, or PANAS with a moderate design effect (0.30) according to *Chen et al. (2010)*, at 95% level of confidence and 80% study power. Using the G\*Power software package, the required sample size was 90 for each group. This was increased to 100 in each group (Vipassana and Shamatha) to compensate for dropouts and attrition. Thus, 200 students were recruited, 50 from each school grade using systematic random sampling technique from each grade. The 200 students were then randomized into two intervention groups (Vipassana and Shamatha) using a simple randomization method. The selected participants signed an informed consent form, and the research protocol was approved by the University Ethics Committee.

### Tools for data collection:

A self-administered questionnaire form with three standardized scales was used in data collection, namely the Revised Test Anxiety Scale, the Automatic Thoughts Questionnaire-Positive (ATQ-P) and the Positive and Negative Affect Schedule (PANAS), in addition to a section for participant's relevant personal characteristics.

**Revised Test Anxiety Scale:** This scale measures students' anxiety preceding taking a test. It was developed by *Benson and El-Zahhar (1994)*, and further modulated and validated in multiple revisions (*Kyriazos and Stalikas, 2018; Irwing and Hughes, 2018*). It is the most widely used measure of test anxiety. The scale has 20 items covering

four domains: Worry (6 items), Tension (5 items), Test-Irrelevant Thinking (4 items), and Bodily Symptoms (5 items). The response to each item is on a 4-point Likert type scale: “Almost Never,” “Sometimes,” “Often,” and “Almost Always.” These are scored from one to four. The scores of each domain and for the total scale are summed-up and standardized providing a score with a maximum of “4”, with a higher score indicating higher anxiety level. The scale has documented high level of validity and reliability (*Mascret et al., 2021*). In the present study, it showed excellent reliability with Cronbach’s alpha coefficient 0.979.

- **Automatic Thoughts Questionnaire-Positive (ATQ-P):** This scale was developed by *Hollon and Kendall (1980)*. The positive version was used in the current study, where participants are asked how often they have experienced the indicated positive thoughts during the preceding week. It has 30 related statements covering four domains: others evaluation of self, positive daily functioning, positive future expectations, and positive self-evaluation. The response to each item is on a 5-point Likert type scale ranging from “never” to “all the time.” These are scored from 1 to 5, respectively. The scores of each domain and of the total scale are summed-up and standardized providing a score with a maximum of “5”, with a higher score indicating more positive automatic thoughts. The scale has documented high level of validity and reliability (*Netemeyer et al., 2002; Ghassemzadeh et al., 2006*). In the present study, it showed excellent reliability with Cronbach’s alpha coefficient 0.993.
- **The Positive and Negative Affect Schedule (PANAS):** Watson developed this scale *et al. (1988)* to measure affect. It consists of 20 items: 10 measuring positive affect (e.g., excited, enthusiastic) and 10 measuring negative affect (e.g., being distressed, upset). The response is on a 5-point Likert type scale: “Very slightly or not at all,” “A little,” “Moderately,” “Quite a bit.”, and

“Extremely.” These are scored from 1 to 5, respectively. The scores of the positive and negative domains are summed-up separately and standardized providing a score with a maximum of “5”, with a higher score indicating more positive and more negative affect, respectively. The scale has documented high level of validity and reliability (*Crawford and Henry, 2004*). In the present study, it showed excellent reliability with Cronbach’s alpha coefficients 0.978 and 0.962 for the positive and negative domains.

### **Pilot study:**

The data collection form was pilot tested on ten students from the setting to assess its clarity and the practicability of the study procedures. The tool was adjusted based on the pilot’s results, and the ten students were excluded from the main study to prevent contamination bias.

### **Fieldwork:**

The research was done between the beginning of November 2023 and the end of May 2024. At the beginning of the interview, the researchers introduced themselves, welcomed each nursing student, and discussed the purpose and nature of the study.

### **The intervention:**

The study involved two different interventions, namely Vipassana and Shamatha meditation techniques. This latter technique is based on focusing concentration to calm the mind and manage negative thoughts. On the other hand, Vipassana tends to help see the aspects of present moment experience with more clarity and less judgement. It thus tends to expand the meditator’s field of consciousness to include other sensory experiences, with better insight into the mind and body. It also fosters non-judgmental pursuing of any of one’s five senses. It thus helps in reducing

negative thoughts though identifying what really counts in life, with more calmness and happiness in the present moment.

The enrolled students in each group were subdivided into small groups of 10 students each. They received their designated training in Vipassana or Shamatha therapy, in 20-30-minute daily sessions over a period of five days. They were then instructed to perform it daily at home for the remaining 30 days. In the introductory session, the trainer explained how meditation can help them better focus on what they wanted to do. The trainer explained the training's nature, time commitment, daily practice, recording, and any observations, thoughts, and questions that arose after daily meditation practice.

Then, each student met with the trainer daily for 10 min of meditation instruction, as needed, and a short practice session. The training was provided in the garden in the Faculty of Nursing, daily for 5 days, with gradual increase in the meditation time to reach to 20-30 min a day. The trainees were instructed to avoid talking or communication of any kind, not even eye or physical contact or any gestures. No reading or writing materials of any kind were used. No eating or drinking was allowed. The training program preceded their tests.

**Shamatha intervention:** Every session starts with seating comfortably in the Vairocana 7-point meditative posture: 1) Sitting comfortably with legs crossed in the full- or half-lotus posture as comfortable; 2) Keeping awareness directed inward, and body upright; 3) Keeping shoulders relaxed and even, with right hand over the left, resting hands on thigh; 4) Keeping eyes slightly open and fixed on tip of nose; 5) Keeping head position with nose and navel aligned; 6) Keeping tongue tip upwards to the palate behind upper teeth; 7) Letting teeth and lips rest in natural position. Body and mind should be quiet and focus on the present moment while breathing in and out

gently, simply being aware of inhalation and exhalation. A strong motivation should be set to overcome faults of laxity and excitement during the meditation sessions. With training and daily practice, the prattling disorderly mind gains more calmness and clarity.

**Vipassana intervention:** This self-observation technique helps trainee acquire a feeling of equanimity to get rid of the cycle of craving and aversion. The technique is not actually taught until the fourth day of training. The first three days are dedicated to controlling the mind by realizing the true changing nature of reality using breathing. The trainee is instructed to concentrate on the upper lip area below the nostrils and focus on the expired air as it graces this area. After three days, the mind is calm, and students are taught Vipassana meditation where they learn to observe the subtle sensations throughout the body without reacting to them. If a sensation is pleasurable, one can observe it and let it pass; if not, it can be observed, and watched to pass. If this understanding is mastered, one can apply it to whole life.

After the completion of the one-month training, students were asked to fill in the data collection form for post-intervention evaluation.

### **Administrative and ethical considerations:**

The researchers got the required official permissions to conduct the study through official channels. The study protocol was approved by the Research Ethics Committee at the Faculty of Nursing, Ain-Shams university, approval number (23.11.167). All Helsinki Declaration research ethics principles were abided with. An informed written consent was obtained from each student at recruitment.

### **Statistical analysis:**

The data management was done using IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA). The reliability of the scales used was examined through testing their internal consistency using Cronbach alpha analysis. Chi-squared tests were applied in categorical variables analyses, and Mann-Whitney tests for numeric ones. Multiple linear regression analyses were conducted to show the independent predictors of the scores of TA, ATQ-P, and PANAS. Statistical significance was considered at  $p < 0.05$ .

### Results:

**Table 1** points to no significant differences in nursing students' demographic characteristics between the Vipassana and Shamatha groups. Their age was mostly  $< 26$  years, with slightly more than a half in both groups being males, 52.0 and 55.0%, respectively. Although more students in the latter group were having very good or excellent grades, the difference was at the border of statistical significance ( $p = 0.05$ ), and there was no difference in the failure rate between the two groups ( $p = 0.55$ ).

As illustrated in **Table 2**, the nursing students in both groups had high pre-intervention scores of test anxiety, with medians of 3.0 or higher out of a maximum score of 4.0. Conversely, they had low scores of Automatic Thoughts Positive (ATQ-P). Similarly, their PANAS negative scores were high while their PANAS positive scores were low. It is noticed that the students in the Shamatha group had significantly higher pre-intervention scores of tensions ( $p = 0.03$ ) and total anxiety ( $p = 0.02$ ), and lower score of positive self-evaluation of the ATQ-P ( $p = 0.048$ ) although they had equal medians (1.83). However, these significant differences between the two groups disappeared at the post-intervention phase, with improvements in all scores in both groups.

**Table 3** proves the effectiveness of both meditation techniques in decreasing nursing students' scores of test anxiety and negative PANAS, while increasing their scores of ATQ-P and PANAS positive scores. These improvements were evident in all three scales as well as their subscales in the two groups ( $p < 0.001$ ). In the test anxiety scale, the highest improvements were in body symptoms and worry subscales in both groups. In the ATQ-P scale, the highest increase in both groups was in the "others evaluation" subscale (median 4.50). The median PANAS negative score fell to 1.00 and 1.15 of a maximum score of 5.00 in the Vipassana and Shamatha groups, respectively.

The multivariate analysis (**Table 4**) identified time (pre-post) i.e., the use of meditation technique, as the main negative predictor of the test anxiety score. On the other hand, the Vipassana technique and female gender were positive predictors, indicating slightly better effect of the Shamatha technique, and more effectiveness among male students. These factors explain 74% of the improvement in students' test anxiety scores.

As regards the ATQ-P scores, **Table 5** indicates that the use of meditation techniques (time pre-post), is the main positive predictor of the ATQ-P score, explaining 71% of its increase. Meanwhile, the addition of the Test Anxiety (TA) score to the model, it turned to be a significant negative predictor of the ATQ-P score and increased its r-squared value to 77%.

In **Table 6**, time (pre-post) i.e., the use of meditation technique, was identified as the main negative predictor of the PANAS -ve score, in addition to female gender. These two factors explain 71% of the decrease in students' PANAS -ve scores. The addition of the TA and ATQ-P scores to the model increased its chi-squared value to 75%, with TA being a positive predictor and ATQ-P a negative predictor. As for the

PANAS +ve score, the same table shows that the use of meditation technique (time pre-post) is its main positive predictor, while the school year is a negative predictor. They both explain 73% of the variation in the PANAS +ve score. The addition of the TA

and ATQ-P scores to the model as well as the residence increased its chi-squared value to 79%, with TA being a negative predictor and ATQ-P a positive predictor.

**Table 1: Demographic characteristics of students in the two study groups**

	Group				X <sup>2</sup> test	p-value
	Vipassana (n=100)		Shamatha (n=100)			
	No.	%	No.	%		
Age:						
<26	78	78.0	83	83.0	0.80	0.37
26-30	22	22.0	17	17.0		
Academic years:					0.04	1.00
1	25	25.0	26	26.0		
2	25	25.0	25	25.0		
3	25	25.0	25	25.0		
4	25	25.0	24	24.0		
Gender:					0.18	0.67
Male	52	52.0	55	55.0		
Female	48	48.0	45	45.0		
Marital status:					Fisher	0.68
Single	98	98.0	96	96.0		
Married	2	2.0	4	4.0		
Residence:					0.18	0.67
Urban	53	53.0	50	50.0		
Rural	47	47.0	50	50.0		
Living alone:					0.00	1.00
No	90	90.0	90	90.0		
Yes	10	10.0	10	10.0		
GPA:					9.49	0.05
Fail	5	5.0	7	7.0		
Adequate	29	29.0	14	14.0		
Good	32	32.0	28	28.0		
Very good	27	27.0	38	38.0		
Excellent	7	7.0	13	13.0		
Previous failure:					0.35	0.55
No	95	95.0	93	93.0		
Yes	5	5.0	7	7.0		

**Table 2: Comparison of pre- and post-intervention scores of Test Anxiety, Automatic Thoughts Positive (ATQ-P) and Positive and Negative Affect Schedule (PANAS) between the two study groups**

	Vipassana (n=100)		Shamatha (n=100)		Mann Whitney test	p- value
	Mean±SD	Median	Mean±SD	Median		
<b>Pre-intervention</b>						
Anxiety (max=4):						
Body symptoms	3.0±0.5	3.00	3.1±0.6	3.00	2.79	0.09
Irrelevant thinking	3.0±0.5	3.13	3.1±0.6	3.25	3.26	0.07
Tension	3.0±0.5	3.00	3.1±4.0	3.20	4.77	0.03*
Worry	3.0±0.5	3.00	3.1±0.4	3.17	2.41	0.12
Total anxiety	3.0±0.4	3.00	3.1±0.5	3.05	5.53	0.02*
ATQ-P (max=5)						
Others evaluation	1.9±0.6	1.75	1.9±0.5	1.86	0.50	0.48
+ve daily functioning	2.0±0.6	1.95	1.9±0.6	1.78	2.61	0.11
+ve future expectations	2.0±0.6	2.00	1.9±0.6	1.67	1.54	0.22
+ve self-evaluation	2.0±0.6	1.83	1.9±0.7	1.83	3.91	0.048*
Total ATQ-P	2.0±0.5	1.93	1.9±0.6	1.83	3.74	0.053
PANAS (max=5)						
Negative	3.4±0.8	3.50	3.5±0.6	3.50	0.14	0.71
Positive	1.5±0.6	1.20	1.6±0.7	1.30	0.32	0.57
<b>Post-intervention</b>						
Anxiety (max=4):						
Body symptoms	1.5±0.5	1.20	1.5±0.5	1.40	1.57	0.21
Irrelevant thinking	1.5±0.5	1.50	1.5±0.5	1.50	0.00	1.00
Tension	1.5±0.5	1.40	1.5±0.5	1.40	0.00	0.98
Worry	1.5±0.4	1.33	1.5±0.5	1.33	0.07	0.79
Total anxiety	1.5±0.4	1.35	1.5±0.5	1.38	0.10	0.75
ATQ-P (max=5)						
Others evaluation	4.3±0.8	4.50	4.2±1.0	4.50	0.05	0.82
+ve daily functioning	4.2±0.8	4.33	4.1±0.9	4.44	0.01	0.93
+ve future expectations	4.2±0.9	4.33	4.1±1.0	4.33	1.35	0.25
+ve self-evaluation	4.2±8.3	4.33	4.1±0.9	4.33	0.04	0.84
Total ATQ-P	4.2±0.8	4.45	4.1±0.9	4.40	0.13	0.71
PANAS (max=5)						
Negative	1.4±0.6	1.00	1.5±0.7	1.15	1.29	0.26
Positive	4.2±0.8	4.25	4.1±1.0	4.20	0.34	0.56

(\* ) Statistically significant at  $p < 0.05$

**Table 3: Comparison of pre- and post-intervention scores of Test Anxiety, Automatic Thoughts Positive (ATQ-P) and Positive and Negative Affect Schedule (PANAS) within the two study groups**

	Pre (n=100)		Post (n=100)		Mann Whitney test	p-value
	Mean±SD	Median	Mean±SD	Median		



	Pre (n=100)		Post (n=100)		Mann Whitney test	p-value
	Mean±SD	Median	Mean±SD	Median		
<b>Vipassana group</b>						
Anxiety (max=4):						
Body symptoms	3.0±0.5	3.00	1.5±0.5	1.20	132.41	<0.001*
Irrelevant thinking	3.0±0.5	3.13	1.5±0.5	1.50	131.72	<0.001*
Tension	3.0±0.5	3.00	1.5±0.5	1.40	133.07	<0.001*
Worry	3.0±0.5	3.00	1.5±0.4	1.33	130.83	<0.001*
Total anxiety	3.0±0.4	3.00	1.5±0.4	1.35	135.59	<0.001*
ATQ-P (max=5)						
Others evaluation	1.9±0.6	1.75	4.3±0.8	4.50	121.27	<0.001*
+ve daily functioning	2.0±0.6	1.95	4.2±0.8	4.33	120.22	<0.001*
+ve future expectations	2.0±0.6	2.00	4.2±0.9	4.33	117.75	<0.001*
+ve self-evaluation	2.0±0.6	1.83	4.2±0.8	4.33	119.85	<0.001*
Total ATQ-P	2.0±0.5	1.93	4.2±0.8	4.45	118.44	<0.001*
PANAS (max=5)						
Negative	3.4±0.8	3.50	1.4±0.6	1.00	137.55	<0.001*
Positive	1.5±0.6	1.20	4.2±0.8	4.25	138.85	<0.001*
<b>Shamatha group</b>						
Anxiety (max=4):						
Body symptoms	3.1±0.6	3.00	1.5±0.5	1.40	125.98	<0.001*
Irrelevant thinking	3.1±0.6	3.25	1.5±0.5	1.50	128.23	<0.001*
Tension	3.1±0.5	3.20	1.5±0.5	1.40	127.32	<0.001*
Worry	3.1±0.4	3.17	1.5±0.5	1.33	129.33	<0.001*
Total anxiety	3.1±0.5	3.05	1.5±0.5	1.38	131.46	<0.001*
ATQ-P (max=5)						
Others evaluation	1.9±0.5	1.75	4.2±1.0	4.50	117.99	<0.001*
+ve daily functioning	1.9±0.6	1.78	4.1±0.9	4.44	112.47	<0.001*
+ve future expectations	1.9±0.6	1.67	4.1±1.0	4.33	109.82	<0.001*
+ve self-evaluation	1.9±0.7	1.83	4.1±0.9	4.33	119.60	<0.001*
Total ATQ-P	1.9±0.6	1.83	4.1±0.9	4.40	116.83	<0.001*
PANAS (max=5)						
Negative	3.5±0.6	3.50	1.5±0.7	1.15	136.79	<0.001*
Positive	1.6±0.7	1.30	4.1±1.0	4.20	128.94	<0.001*

(\* ) Statistically significant at  $p < 0.05$

**Table 4: Multiple linear regression model for the test anxiety score**

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper

Test anxiety score							
Constant	55.66	2.04		27.28	<0.001	51.65	59.67
Group (ref. Vipassana)	1.62	0.91	0.05	1.78	0.08	-0.17	3.41
Time (pre-post)	-30.76	0.91	-0.86	-33.85	<0.001	-32.54	-28.97
Gender (ref. male)	1.88	0.91	0.05	2.06	0.04	0.09	3.67
r-square=0.74      Model ANOVA: F=384.31, p<0.001 Variables entered and excluded: group*time interaction, age, year, marital status, residence, living status, GPA							

**Table 5: Multiple linear regression model for the ATQ-P scores**

	Unstandardized Coefficients		Standardized Coefficients	t-test	P-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
<b>ATQ-P score</b>							
<b>Model I:</b>							
Constant	58.95	1.52		38.89	<0.001	56.0	61.9
Time (pre-post)	66.15	2.14	0.84	30.85	<0.001	61.9	70.4
r-square=0.71      Model ANOVA: F=951.99, p<0.001							
<b>Model II: adding TA score</b>							
Constant	130.72	7.14		18.31	<0.001	116.69	144.76
Time (pre-post)	32.58	3.73	0.41	8.74	<0.001	25.25	39.91
TA score	-1.091	0.10	-0.50	-10.47	<0.001	-1.30	-0.89
r-square=0.77      Model ANOVA: F=441.71, p<0.001 Variables entered and excluded: group, group*time interaction, age, gender, year, marital status, residence, living status, GPA							

**Table 6: Multiple linear regression model for the test PANAS -ve and +ve scores**

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
<b>PANAS -ve score</b>							
Model I:							
Constant	36.26	1.07		34.00	<0.001	34.16	38.36
Time	-20.45	0.65	-0.84	-31.25	<0.001	-21.74	-19.16
Gender (ref. female)	-1.15	0.66	-0.05	-1.75	0.08	-2.44	0.14
r-square=0.71      Model ANOVA: F=948.94, p<0.001							
Model II: adding TA and ATQ scores							
Constant	32.00	2.93		10.92	<0.001	26.24	37.76
Time	-11.10	1.30	-0.46	-8.52	<0.001	-13.66	-8.54
Gender (ref. female)	-1.42	0.61	-0.06	-2.32	0.02	-2.62	-0.22
TA score	0.15	0.04	0.22	3.91	<0.001	0.07	0.22
ATQ-P score	-0.07	0.02	-0.24	-4.56	<0.001	-0.10	-0.04
r-square=0.75      Model ANOVA: F=301.55, p<0.001 Variables entered and excluded: group, group*time interaction, age, year, marital status, residence, living status, GPA							
<b>PANAS +ve score</b>							
Model I:							
Constant	17.92	1.04		17.23	<0.001	15.88	19.96
Time	25.54	0.79	0.85	32.35	<0.001	23.98	27.09
Year	-0.96	0.35	-0.07	-2.72	0.007	-1.65	-0.27
r-square=0.73      Model ANOVA: F=526.93, p<0.001							
Model II: adding TA and ATQ scores							
Constant	22.78	3.51		6.49	<0.001	15.88	29.69
Time	11.62	1.48	0.39	7.83	<0.001	8.70	14.53
Year	-1.22	0.31	-0.09	-3.92	<0.001	-1.83	-0.61
Residence (ref. urban)	-1.54	0.69	-0.05	-2.22	0.03	-2.90	-0.18
TA score	-0.16	0.04	-0.19	-3.81	<0.001	-0.25	-0.08
ATQ-P score	0.14	0.02	0.35	7.40	<0.001	0.10	0.17
r-square=0.79      Model ANOVA: F=299.70, p<0.001 Variables entered and excluded: group, group*time interaction, age, gender, marital status, living status, GPA							

## Discussion

This study tested the hypothesis that the use of the meditation techniques, either

Vipassana or Shamatha lead to improvements in nursing students' test anxiety, ATQ-P and PANAS scores. The results demonstrated statistically significant decreases in students' test anxiety and PANAS -ve scores, and statistically significant increases in their ATQ-P and PANAS +ve scores. Based on these findings, the stated research hypothesis can be accepted.

The comparison of the nursing students in the Vipassana and Shamatha groups revealed no statistically significant differences, indicating the success of the randomization process. The nursing students in both groups had high scores of test anxiety at the pre-intervention phase. Their median scores in all subscales of the Test Anxiety (TA), reaching 75% or higher out of the maximum score. These high scores reflect the prominent level of anxiety these students experience before taking a test. Similarly high levels of anxiety were reported among midwifery students in Iran (*Moradi et al., 2021*).

The implementation of the present study meditation techniques led to significant decreases in nursing students' scores of test anxiety. This was particularly noticed in the body symptoms and worry subscales of the test anxiety score. The finding points to the effectiveness of the meditation techniques in the alleviation of students' test anxiety.

It was also corroborated by the results of the multivariate analysis where the implementation of any of the two techniques was identified as a significant negative predictor of the test anxiety score. In agreement with this, a study on nursing students in Spain demonstrated the positive effect of various relaxation techniques, such as guided breathing and social support, on their test anxiety preceding their final exam (*Ortega-Donaire et al., 2023*).

This present study beneficial effect of meditation might be explained by the "peace of mind" it creates in students, with alleviation of stress before taking the tests. In this respect, a study in Sri-Lanka demonstrated increased levels of melatonin and serotonin among those using the Vipassana meditation technique, which would lead to more calmness and better mood (*Thambyrajah et al., 2023*).

Similarly, in a study in the United States (*Zanesco et al., 2019*), the practice of Shamatha was shown to increase attention and improve vigilance, which could explain its beneficial effect on test anxiety.

According to the current study multivariate analysis, the use of the Vipassana meditation technique seems to be slightly less effective in comparison with the Shamatha technique. This might be explained by this latter technique's effect on the cardiac vagal tone and ability to maintain attention and regulate emotions.

In line with this, a study in the Netherlands revealed that the regular practice of Shamatha meditation was associated with diurnal cortisol level changes with autonomic balance through increased vagal tone (*Blase and van Waning, 2019*).

Furthermore, being a female students turned to be a positive predictor of the test anxiety score. Thus, the use of the meditation technique is more effective in the alleviation of male students' test anxiety in comparison to their female peers. This could be explained by the higher emotional liability among females especially in our community as in many developing countries (*Megreya et al., 2023*).

This was even demonstrated in developed countries. Thus, a study on Canadian students revealed that female

ones demonstrated a higher susceptibility to test anxiety in comparison with their male peers (*Journault et al., 2022*).

Similar findings were also reported in a study on American students (*Burkholder and Salehi, 2022*). The finding was put in more evidence in a recent systematic review and meta-analysis, which confirmed higher test anxiety among female students (*Robson et al., 2023*).

The present study has also investigated the effect of the two meditation techniques on nursing students' ATQ-P score. At baseline, the nursing students' ATQ-P scores were low, with slightly lower scores in the Shamatha group. At the post-intervention phase of the current study, the nursing students' ATQ-P scores significantly increased in both groups.

This was especially noticed regarding the subscale of "others evaluation." This can certainly be attributed to the direct positive effect of the meditation techniques, which was identified as the main positive predictor of the ATQ-P score.

Moreover, the test anxiety score was identified as a significant negative predictor of this score, which would point to an indirect effect of the meditation techniques on the ATQ-P score through decreasing the test anxiety score. Meanwhile, no difference between the two meditation techniques in their effect on the ATQ-P scores could be demonstrated.

In congruence with this, a study in China reported that the participants in a brief mindfulness intervention had improved emotion processing and better responses to positive and negative emotional stimuli (*Wu et al., 2019*).

On the same line a study of cognitive behavioral therapy effectiveness

in reducing nursing students' anxiety and automatic thoughts in Türkiye demonstrated improved depressive symptoms and automatic thoughts among them (*Demir and Ercan, 2022*). Similar positive effects on automatic negative thoughts were also reported in a study on young adults in Australia (*Hallford et al., 2022*).

Lastly, the present study examined the effect of the meditation techniques on nursing students' PANAS scores. The pre-intervention positive PANAS scores were low, while the negative PANAS scores were high in both groups. The use of any of the two meditation techniques was identified as a main negative predictor of the PANAS -ve score.

Conversely, it was a positive predictor of the PANAS +ve score. These results indicate that either of the two techniques has a direct beneficial effect on nursing students' PANAS. Furthermore, the meditation techniques had indirect beneficial influences on nursing students the PANAS +ve and -ve scores. This was through their effect on the students test anxiety (TA) and ATQ-P scores.

Thus, the TA score was a positive predictor of the PANAS -ve score and a negative predictor of the PANAS +ve score. Conversely, the ATQ-P was a negative predictor of the PANAS -ve score and a positive predictor of the PANAS +ve score.

This indicates that the meditation techniques would increase students' PANAS +ve through alleviating their anxiety and increasing their positive automatic thoughts, and the reverse is true for their PANAS -ve scores.

In agreement with these results, a study in Australia found that the practice of meditation techniques such as Vipassana had a significant beneficial effect on participants' PANAS, and a dose-

response relationship was revealed between such practice and emotional wellbeing (*Bowles et al., 2022*).

### Conclusion:

Based on the findings of this study, it is concluded that the use of Vipassana or Shamatha meditation techniques can alleviate nursing students' test anxiety and improve their automatic negative thoughts as well as their affect. The techniques are easily taught and are acceptable by students.

### Recommendations:

The following recommendations are suggested based on the results of the present study:

- Incorporating mindfulness meditation intervention programs focusing on stress and anxiety management into the curriculum of education.
- Boost students' competence to manage stress and anxiety by using mindfulness meditation techniques.
- Developing interventions that can provide students with support as they fight with a test anxiety problem.
- Further studies add in arranging sessions at accessible times for students and ensuring the environment is favorable to mindfulness meditation and obtaining greater participation.
- The effects of mindfulness meditation techniques on tests' scores and academic performance need to be further studied.

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