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A Comparative Analysis of Positive Mindfulness and Cognitive Emotion Regulation Training on Automatic Thoughts and Optimism Among Medical Science Students

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Abstract

Background: Medical training is notoriously demanding, exposing students to significant stressors such as heavy workloads, high-stakes examinations, exposure to suffering and death, and pressure to perform. These factors can lead to increased levels of stress, anxiety, depression, and burnout, negatively impacting students' mental health and well-being.

Objectives: This study aimed to investigate the effectiveness of positive mindfulness training (PMT) and cognitive emotion regulation training (CERT) on automatic thoughts and optimism in medical sciences students.

Methods: This quasi-experimental study employed a pre-test, post-test, and follow-up design to examine the effects of PMT and CERT on medical students at Jundishapur University of Medical Sciences (Ahvaz) during the 2022 academic year. A convenience sample of 45 students was randomly assigned to a PMT group, a CERT group, or a control group. Participants in the two intervention groups received ten 90-minute sessions of their respective training programs, while the control group received no intervention. Data on automatic thoughts and optimism were collected using the Negative Automatic Thoughts Questionnaire and the optimism subscale of the Emotional Quotient Inventory (EQ-I). Data analysis was conducted using repeated measures analysis of variance (ANOVA) with Bonferroni post-hoc tests (SPSS v. 27).

Results: The findings indicated that both PMT and CERT were effective in reducing negative automatic thoughts and enhancing optimism among medical sciences students at the post-test stage ($P < 0.001$). These effects were sustained at the follow-up assessment, with no significant difference in effectiveness between the two intervention groups.

Conclusions: The results demonstrated that both PMT and CERT were effective in decreasing negative automatic thoughts and increasing optimism among medical sciences students. A key implication of these findings is the potential for incorporating mindfulness and cognitive emotion regulation techniques into medical education curricula.

Keywords: Mindfulness, Cognitive, Emotions, Optimism, Students

1. Background

Students encounter various academic stressors that can negatively affect their mental well-being, including separation from family, demanding academic environments, financial difficulties, heavy workloads, and intense competition (1). Medical science students face additional stressors related to clinical settings, such as hospital environments, patient interactions, and uncertain career prospects, placing them at a higher risk for mental health challenges (2). The transition to university life is inherently stressful due to significant life changes (3). Research indicates that students entering university are vulnerable to psychological and social issues and stress-exacerbating factors, often experiencing varying degrees of psychological distress, including anxiety, depression, and stress (4).

Negative automatic thoughts significantly contribute to psychological distress in students, impairing their ability to cope with life experiences and disrupting their internal equilibrium. These situation-dependent and involuntary thoughts typically arise during emotional distress, such as depression and anxiety, and despite seeming logical, they are difficult to dismiss (5). Often operating outside conscious awareness, they are considered a transdiagnostic factor

associated with constructs such as worry, intolerance of uncertainty, and metacognitive beliefs about the thoughts themselves. During periods of poor mental health, individuals tend to ruminate on negative themes (6). Those predisposed to psychological distress exhibit a persistent tendency toward negative ideation, which perpetuates their existing vulnerabilities.

Negative automatic thoughts are defined as images or cognitions that result from activated cognitive schemas or core beliefs in specific contexts. These thoughts shape individual interpretations of situations and are intrinsically linked to emotional and behavioral responses (7). Furthermore, they play a crucial role in therapy by providing insight into the cognitive system and facilitating an understanding of the core beliefs underlying various psychological disorders (8).

Optimism and positive beliefs play a vital role in shaping human health and well-being. Optimism is conceptualized as the tendency to attribute positive outcomes to both present and future successes (9). Conversano et al. (10) argue that optimism is a learned trait, asserting that acquiring skills to reframe thoughts toward optimism following adverse events contributes to improved well-being. Additionally, optimism is understood as the general expectation that positive outcomes are more likely than negative ones across various life situations (11).

Lee-Flynn et al. (12) suggest that an affirmative self-concept, a sense of personal control, and an optimistic disposition enable individuals to manage daily life challenges more effectively and cope with stressors. Moreover, optimistic beliefs foster positive perceptions of future events and have demonstrated predictive validity for improved psychological and physical health (13).

Various therapeutic approaches exist to enhance psychological well-being, including mindfulness training (14). Positive mindfulness training (PMT), rooted in psychology, enhances the effectiveness of various training modalities, demonstrating positive effects on well-being, mindfulness, gratitude, self-compassion, autonomy, health, self-efficacy, meaning in life, and compassion for others (15). Given the role of mindfulness training in enhancing psychological characteristics and the contribution of psychological interventions to promoting well-being and resilience, the integration of these two approaches, termed PMT, has the potential to improve psychological states (16). Psychological interventions have been shown to be effective in enhancing various characteristics, particularly psychological attributes such as hope, optimism, and well-being (17). Structurally, as well as in theoretical and practical content, PMT employs a dual focus — freeing the mind from evaluating past and future events while simultaneously concentrating on present strengths and positive aspects (18).

Cognitive emotion regulation training (CERT) is a structured intervention designed to enhance emotional management abilities (19). Based on Gross's process model of emotion regulation, CERT focuses on modifying cognitive processes during the generation of emotions rather than solely targeting emotional responses (20). The training includes psychoeducation about emotions and their regulation, followed by instruction and practice of specific cognitive strategies. These strategies include cognitive reappraisal, acceptance, putting into perspective, positive refocusing, refocusing on planning, and positive reappraisal (21). The CERT aims to provide individuals with adaptive cognitive strategies, enabling flexible emotion regulation in response to stressors and ultimately improving psychological well-being. By targeting cognitive processes that precede emotional responses, CERT seeks to promote adaptive emotional experiences while reducing reliance on maladaptive strategies such as rumination or suppression (22).

The demanding nature of medical training exposes students to significant stressors, including heavy workloads, high-stakes examinations, and exposure to patient suffering. These stressors can negatively impact their mental health and well-being, leading to increased stress, anxiety, and depression. Given the established link between negative automatic thoughts and these mental health challenges, as well as the importance of optimism for resilience, there is a need to identify effective interventions tailored to this population. While both PMT and CERT have shown promise in improving mental well-being, a direct comparison of their efficacy in reducing negative automatic thoughts and fostering optimism among medical science students remains lacking.

2. Objectives

Therefore, this research aims to conduct a comparative analysis of PMT and CERT on automatic thoughts and optimism among medical science students to determine their relative effectiveness and inform best practices for student support.

3. Methods

A quasi-experimental design employing a pre-test, post-test, and follow-up protocol with a control group was implemented. The study population comprised all

medical students at Jundishapur University of Medical Sciences in Ahvaz who sought academic counseling services at the university counseling centers during the 2022 - 2023 academic year. Forty-five students were selected from this population through convenience sampling, adhering to predefined inclusion and exclusion criteria. The sample size was determined a priori through a power analysis using G*Power software.

Participants were randomly assigned to one of three groups: A PMT experimental group (n = 15), a CERT experimental group (n = 15), or a control group (n = 15). Inclusion criteria required a diagnosis of academic difficulties following consultation at the university counseling center, absence of severe mental disorders (e.g., psychosis), an age range of 20 - 35 years, completion of at least four academic semesters, and provision of written informed consent.

Exclusion criteria included prior participation in PMT within the preceding two years, current psychotropic medication use, and non-compliance with or absence from two consecutive intervention sessions.

3.1. Measure

3.1.1. The Negative Automatic Thoughts Questionnaire

The Negative Automatic Thoughts Questionnaire, developed by Hollon and Kendall (23), consists of 30 items scored on a Likert Scale ranging from 1 (never) to 5 (always). Total scores range from 30 to 150, with higher scores indicating a greater prevalence of negative automatic thoughts. Ghassemzadeh et al. (24) reported a Cronbach's alpha reliability coefficient of 0.96 for this questionnaire. In the present study, the reliability of this instrument was assessed using Cronbach's alpha, yielding a coefficient of 0.89.

3.1.2. The Bar-On Emotional Quotient Inventory (EQ-I)

The optimism subscale from the Bar-On Emotional Quotient Inventory (EQ-I) was utilized. This inventory, developed by Bar-On (25), is one of the first cross-cultural instruments designed to assess emotional intelligence. The EQ-I is a 90-item measure of emotional intelligence that employs a five-point Likert Scale ranging from "never" to "always". Responses are scored from 1 to 5 based on the participant's selection. The questionnaire comprises 15 subscales, but in the present study, only the six items related to the optimism subscale were used. The reliability of the overall EQ-I, as determined by Cronbach's alpha, was reported as 0.94 by Nejati and Meshkat (26). In the current research, Cronbach's alpha was used to assess the reliability of this specific subscale, yielding a coefficient of 0.83.

3.1.3. Interventions

The PMT group received ten 90-minute training sessions, while the CERT group participated in an equivalent number of 90-minute sessions. The session content for both PMT and CERT is detailed in Tables 1 and 2, respectively. Post-intervention assessments were administered immediately after the completion of the training programs, with a follow-up assessment conducted 45 days later for all three groups (PMT, CERT, and control).

3.2. Data Analysis

Data analysis for this research utilized descriptive statistics, including means and standard deviations (SD), along with inferential statistics, specifically repeated measures analysis of variance (ANOVA) and the Bonferroni post-hoc test. All analyses were performed using SPSS version 27 software.

4. Results

The study sample consisted of 45 medical students (27 female, 18 male) with a mean age of 26.70 years (SD = 6.32). Means and SD for automatic thoughts and optimism scores across the PMT, CERT, and control groups at pre-test, post-test, and follow-up assessments are presented in Table 3.

Before testing the study hypotheses, data were assessed for adherence to the assumptions of repeated measures ANOVA. Kolmogorov-Smirnov tests confirmed the normality of variable distributions, and Levene's tests indicated homogeneity of variances. Mauchly's test of sphericity revealed a violation of the sphericity assumption; therefore, the Greenhouse-Geisser correction was applied.

Table 4 presents the results of the repeated measures ANOVA examining changes in automatic thoughts and optimism across the three assessment time points (pre-test, post-test, and follow-up) for the PMT, CERT, and control groups. Significant main effects of time were observed for both automatic thoughts and optimism ($P < 0.001$). A significant interaction between group and time was also found for both dependent variables ($P < 0.001$). Additionally, significant between-group differences in automatic thoughts and optimism were identified ($P < 0.001$).

Table 5 presents the results of the Bonferroni post-hoc tests conducted to identify specific group

Table 1. A Summary of Positive Mindfulness Training Sessions

Sessions	Content
1	Establishing rapport between the instructor and participants, introductions, outlining session rules and objectives, and providing a comprehensive overview of the PMT method's structure.
2	Explaining mastectomy and associated depression and psychological issues, introducing mindfulness, self-awareness, positive psychology, and meditation, and familiarizing participants with focused attention meditation on breath, body, and emotions.
3	Discussing positive emotions and gratitude, and practicing a gratitude meditation focused on expressing appreciate on for individuals or things.
4	Explaining self-compassion, reviewing related research, teaching methods to enhance self-compassion, and introducing and practicing a loving-kindness meditation with an emphasis on self-compassion.
5	Introducing character strengths and virtues and self-efficacy, along with methods for their improvement, and engaging in a meditation focused on instances where participants optimally utilized their character strengths and virtues.
6	Introducing autonomy and explaining its relationship with well-being, and practicing a meditation based on the authentic self.
7	Discussing meaning and explaining its association with well-being, conducting a writing exercise describing one's best possible legacy or memories to practice awareness of the past, and meditating on visualizations of potential future legacies.
8	Discussing the benefits of positive relationships with others, teaching ways to improve positive relationships, and practicing a loving-kindness meditation.
9	Explaining commitment and savoring, discussing their connection to positive emotions, and teaching a savoring meditation focused on food.
10	Practicing the strategies learned in previous sessions, summarizing and concluding the sessions with participant input, emphasizing commitment to applying the learned material in real life, and expressing gratitude to the participants.

Abbreviation: PMT, positive mindfulness training.

Table 2. A Summary of Cognitive Emotion Regulation Training Sessions

Sessions	Content
1	Explaining the rationale and stages of the intervention, the necessity of emotion regulation, the appropriate perspectives on emotions, and a review of primary and secondary emotions, emphasizing that all emotions serve a purpose.
2	Providing emotional education, distinguishing between normal and problematic emotions, and focusing on emotional self-awareness, including: 1) Instruction and introduction of emotions, 2) identification, naming, and labeling of feelings, 3) differentiation between various emotions, 4) identifying emotions in physical and psychological states, and 5) factors contributing to success in emotion regulation.
3	Assessing participants' vulnerability and emotional skills, including: 1) Self-assessment to understand personal emotional experiences, 2) self-assessment to identify individual emotional vulnerabilities, 3) self-assessment to identify personal regulatory strategies, 4) the cognitive consequences of emotional reactions, 5) the physiological consequences of emotional reactions, 6) the behavioral consequences of emotional reactions and the interrelationship between these three, and 7) introducing the emotion of anger and strategies for managing it.
4	Modifying the emotion-eliciting situation, including: 1) Preventing social isolation and avoidance, 2) teaching problem-solving strategies, and 3) teaching interpersonal skills such as communication, assertiveness, and conflict resolution.
5	Shifting attention, including: (1) Stopping rumination and worry; and 2) training attention.
6	Modifying cognitive appraisals, including: (1) Identifying maladaptive appraisals and their effects on emotional states; and (2) teaching reappraisal strategies.
7	Modifying the behavioral and physiological consequences of emotion, including: (1) Identifying the extent and manner of using the inhibition strategy and examining its emotional consequences; (2) exposure; (3) teaching emotion expression; (4) behavior modification through changing environmental reinforcers; and (5) teaching emotional release, relaxation, and opposite action.
8	Reassessment and addressing barriers to application, including: (1) Evaluating progress toward goals; (2) applying learned skills in natural settings outside of the sessions, and 3) examining and addressing barriers to completing assignments.
9 and 10	Reviewing the sessions and practicing the learned skills.

differences following the significant interaction effect observed in the repeated measures ANOVA.

For automatic thoughts, no significant differences were found between the PMT and CERT groups, indicating that both interventions were equally effective in reducing the frequency of automatic thoughts. However, both the PMT and CERT groups showed significantly lower levels of automatic thoughts compared to the control group.

Similarly, for optimism, no significant differences were observed between the PMT and CERT groups, suggesting that both interventions were equally effective in enhancing optimism. However, both the PMT and CERT groups demonstrated significantly higher levels of optimism compared to the control group.

5. Discussion

This study aimed to investigate the efficacy of PMT and CERT in mitigating negative automatic thoughts and enhancing optimism among medical science students. The results indicated that both PMT and CERT were effective in reducing negative automatic thoughts among medical students. These findings align with previous research by Lindsay et al. (16) and Sharifi Fard et al. (21).

Table 3. Means and Standard Deviations of Research Variables

Variables and Phases	PMT Group	CERT Group	Control Group
Automatic thoughts			
Pre-test	73.72 ± 8.56	76.20 ± 7.82	74.93 ± 7.62
Post-test	64.46 ± 8.81	67.60 ± 7.52	73.86 ± 7.49
Follow-up	64.06 ± 9.05	67.26 ± 7.67	73.46 ± 7.68
Optimism			
Pre-test	16.06 ± 2.12	15.73 ± 2.12	17.60 ± 1.91
Post-test	21.20 ± 2.27	20.13 ± 2.38	17.80 ± 2.00
Follow-up	21.46 ± 2.38	20.40 ± 2.47	17.93 ±1.97

Abbreviations: PMT, positive mindfulness training; CERT, cognitive emotion regulation training.

Table 4. Results of the Repeated-Measures Analysis of Variance

Variables and Sources	SS	df	MS	F	P	ηp^2
Automatic thoughts						
Phase	1024.04	1.30	782.92	777.28	0.001	0.94
Group × phase	349.28	2.61	133.52	132.56	0.001	0.86
Group	1026.13	2	513.06	8.65	0.041	0.51
Optimism						
Phase	275.12	1.61	169.97	512.80	0.001	0.92
Group × phase	129.00	3.32	38.85	120.22	0.001	0.85
Group	83.30	2	41.65	9.99	0.030	0.53

To explain these findings, negative automatic thoughts are defined as persistent preoccupations with a specific thought or subject. They are a class of conscious thoughts that revolve around a particular theme, are repetitive, and focus on the causes and consequences of symptoms without immediate environmental demands. These thoughts hinder problem-solving, exacerbate negative thinking, and are more prevalent in individuals predisposed to psychological and emotional distress (5). In individuals vulnerable to psychological and emotional harm, the mind tends to gravitate toward negative thoughts, perpetuating psychological and emotional distress (8).

Mindfulness teaches individuals to be fully present in the moment, enhancing their enjoyment of life. Low mood can trigger memories and thoughts from the past and induce anxiety about the future. Mindfulness helps individuals interrupt the escalation of these negative thoughts, encouraging a focus on the present moment rather than dwelling on past or future concerns (17). When individuals experience low mood, they often react as if their emotions, problems, and difficulties must be solved, leading to the use of critical thinking strategies. However, when these strategies prove ineffective, individuals may become more entrenched in their thoughts, leading to rumination. Mindfulness offers an alternative approach that involves thinking but extends beyond mere cognition. This technique teaches individuals to experience the world directly, without judgment or interpretation (18).

Some emotional styles effectively regulate emotional experiences to achieve valuable goals, while others result in unintended emotional consequences. For instance, attempts to suppress emotions increase physiological arousal, and rumination on negative emotional events prolongs anger and depressive emotional states (19). Conversely, accepting emotional experiences without unnecessary attempts to alter or avoid them is associated with reduced stress and greater persistence in challenging situations. CERT is also a useful approach for individuals with psychological issues as well as non-clinical populations, including students. Self-regulatory strategies play a significant role in educational, cognitive, and clinical psychology, serving as a foundation for purposeful action (21). Accordingly, individuals form beliefs about what they can achieve, predict similar outcomes for future actions, and set goals and plans that lead to desirable consequences.

Table 5. Bonferroni Post-hoc Test for Paired Comparison of the Research Variables

Variables and Groups	Mean Difference	SE	P-Value
Automatic thoughts			
PMT group-CERT group	-0.46	2.99	0.879
PMT group-control group	9.40	2.98	0.004
CERT group-control group	6.26	2.74	0.030
Optimism			
PMT group-CERT group	-1.07	2.33	0.218
PMT group-control group	-3.10	2.14	0.001
CERT group-control group	-2.33	2.19	0.007

Abbreviations: PMT, positive mindfulness training; CERT, cognitive emotion regulation training.

Furthermore, both PMT and CERT were effective in enhancing optimism among medical science students. These findings are consistent with the results of studies by Oh et al. (27) and Xue et al. (28). To explain this finding, optimism and, more generally, positive beliefs have a significant impact on mental health and well-being. Optimism is defined as the tendency to attribute success to both present and future situations (10). Since optimism is learnable, developing the ability to shift one's thoughts toward optimism after setbacks equips individuals with the skills to overcome depression and despair, ultimately promoting greater well-being. Optimism reflects the expectation that positive outcomes are more likely than negative ones in life events and situations (9).

Mindfulness practice empowers individuals to recognize that "thoughts are merely thoughts", and when they understand that their thoughts may not reflect reality, they can more easily let them go. Individuals constantly receive messages from their reasoning mind, and it is crucial for them to be aware of these messages to avoid becoming entangled in their thoughts (27). Moreover, by closely observing their inner reality, individuals realize that happiness is not dependent on external factors or changes in the outside world. Instead, it arises when individuals release attachment to thoughts, preconceived notions, and mental patterns. This process leads to the abandonment of automatic behaviors aimed at seeking pleasure or avoiding pain, ultimately resulting in personal liberation (16).

The study employed a convenience sampling method, which may limit the generalizability of the findings to a broader population of medical students. Additionally, the relatively small sample size of 45 participants may impact the statistical power of the study and limit the generalizability of the results.

5.1. Conclusions

In conclusion, this study provides evidence for the efficacy of both PMT and CERT in reducing negative automatic thoughts and enhancing optimism among medical science students. The improvements observed at the post-test stage were maintained at follow-up, suggesting that these interventions can produce lasting positive changes in this population. Notably, no significant difference was found between the two intervention modalities in their impact on these outcomes. This finding indicates that both approaches are viable options for promoting psychological well-being among medical students, allowing practitioners to select an intervention based on student preferences or available resources.

Further research is needed to explore the long-term effects of these interventions, investigate potential moderators of treatment response, and assess the cost-effectiveness of each approach. Additionally, future studies could examine the potential benefits of combining these interventions to explore possible synergistic effects.

Footnotes

Authors' Contribution: P. A.: Study concept and design, acquisition of data, analysis and interpretation of data, and statistical analysis. F. S. M.: Administrative, technical, and material support, study supervision. S. S.: Critical revision of the manuscript for important intellectual content.

Conflict of Interests Statement: There are no conflicts of interest regarding the publication of the current research.

Data Availability: All data generated or analyzed during this study will be available from the corresponding author on reasonable request.

Ethical Approval: The study was approved by the Ethical Committee of Islamic Azad University, Ahvaz Branch (approval code: IR.IAU.AHVAZ.REC.1403.109).

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