

# Intervention Study on the Impact of Internet-Based Mindfulness Meditation on Depression and Anxiety among University Students

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**Abstract:** This study explores the effectiveness of internet-based mindfulness meditation interventions in mitigating depression and anxiety symptoms among college students. A total of 72 participants were randomly assigned to one of three groups: offline mindfulness intervention, online mindfulness intervention, and a control group. The intervention lasted for eight weeks, during which participants' mental health was assessed using the Patient Health Questionnaire (PHQ-9) and the Generalized Anxiety Disorder Scale (GAD-7). Findings revealed that both interventions significantly reduced depression and anxiety levels, with the offline group exhibiting the most pronounced improvement. The online intervention, while slightly less effective, demonstrated considerable potential, particularly in terms of accessibility and scalability. The study highlights the need for future research to refine online intervention techniques by incorporating greater opportunities for interaction, thereby enhancing participant engagement and intervention efficacy. These findings provide empirical support for the broader application of internet-based mindfulness practices in promoting mental well-being among university populations.

**Keywords:** Mindfulness Meditation; Depression; Anxiety; College Students; Internet-Based Intervention; Mental Health.

## 1. Introduction

Anxiety and depression are pervasive mental health issues in contemporary society, often referred to as the "psychological epidemic of the 21st century." With rapid societal developments and increasing competition across all fields, university students, as a unique group, face multiple pressures related to academics, interpersonal relationships, further education, and employment. This period is not only the onset stage for mental health issues but also a high-risk period. A meta-analysis covering 100,187 university students worldwide revealed prevalence rates of depression and anxiety at 33.6% and 39.0%, respectively [1]. A meta-analysis by Professor Guoliang Yu at Renmin University of China, which included 1,135 datasets, indicated that the detection rates for depression and anxiety among Chinese university students reached 20.8% and 13.7%, respectively [2]. During the global COVID-19 pandemic, the incidence of depression and anxiety among university students further increased [3-4]. Implementing effective measures to promote the recovery of students' mental health is an urgent issue that needs to be addressed.

Mindfulness meditation, a psychological intervention that involves techniques such as sitting meditation, breath awareness, and mindful yoga, helps individuals accept present circumstances in a non-judgmental manner. In recent years, mindfulness meditation has increasingly been integrated into clinical treatments and psychological interventions. Empirical studies have demonstrated that mindfulness meditation significantly improves sleep quality, quality of life, and a sense of life purpose, and it is also effective in reducing anxiety and depression [5-13]. A meta-analysis revealed that the immediate effect size of mindfulness meditation for anxiety interventions was moderate to large [14]. These research results provide substantial empirical support for the widespread application

of mindfulness meditation therapy.

The internet has grown tremendously over the past decade, revolutionizing traditional healthcare services and elevating them to new heights. The first studies on internet-based mindfulness interventions date back to 2014, with Boggs et al. pioneering a randomized controlled trial (RCT) for online mindfulness treatment for anxiety. Their results supported the feasibility of delivering mindfulness meditation online, consistent with previous face-to-face intervention findings, thus providing a foundation for subsequent studies [15]. Additional clinical studies have confirmed the efficacy of mobile internet-based mindfulness meditation interventions. For example, Kir et al. (2021) demonstrated that internet-based mindfulness meditation could alleviate symptoms of anxiety and depression in individuals with post-traumatic stress disorder (PTSD) [16]. Given the accessibility of smartphones and mobile internet, internet-based mindfulness interventions have the potential to become an essential psychological intervention method, offering a suitable option for individuals experiencing depression, anxiety, and other mental health problems.

In summary, with the increasing prevalence of anxiety and depression among university students, exploring internet-based mindfulness interventions is particularly urgent and crucial. Not only does this approach provide a convenient and effective method for students' mental health interventions, but it also offers valuable theoretical and practical support for broader future applications.

## 2. Methodology

### 2.1. Participants

The study recruited 72 university students voluntarily from a university. After an initial interview, students with neurological or psychotic conditions or those taking psychiatric medications were excluded. Participants were divided into three groups: an offline mindfulness meditation

group (24 students), an online meditation group (24 students), and a control group (24 students). The control group did not receive any intervention initially but was later promised offline mindfulness meditation intervention in the second semester. During the study, 3 students from the offline group and 4 students from the online group dropped out. Ultimately, 21 students (13 females, 8 males) completed the 8-week offline mindfulness meditation intervention, and 20 students (12 females, 8 males) completed the 8-week online mindfulness meditation intervention. The control group retained all 24 students (15 females, 9 males).

## 2.2. Measurement Tools

### 2.2.1. Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9), developed by Spitzer et al. and revised by Bian Cuidong et al., was used to assess participants' depression levels over the past two weeks. The PHQ-9 contains 9 items scored on a four-point scale (0–3), with the total score representing the overall depression level. Scores of 0–4 indicate no depression, 5–9 indicate mild depression, 10–14 indicate moderate depression, 15–19 indicate moderate to severe depression, and 20–27 indicate severe depression. In this study, the Cronbach's alpha for the PHQ-9 total score was 0.87.

### 2.2.2. Generalized Anxiety Disorder Scale (GAD-7)

The Generalized Anxiety Disorder Scale (GAD-7), developed by Spitzer et al. and revised by He Xiaoyan et al., was used to assess participants' anxiety levels over the past two weeks. The GAD-7 contains 7 items scored on a four-point scale (0–3), with the total score representing the overall anxiety level. Scores of 0–4 indicate no anxiety, 5–9 indicate mild anxiety, 10–14 indicate moderate anxiety, and 15–21 indicate severe anxiety. In this study, the Cronbach's alpha for the GAD-7 total score was 0.89.

## 2.3. Intervention Methods

The mindfulness meditation intervention was based on the structure of the 8-week Mindfulness-Based Cognitive Therapy (MBCT) course. Each week, participants gathered for one session led by an instructor. The offline group met in the group counseling room at the university's mental health education and counseling center, while the online group used the ZOOM platform for video-based sessions. Each mindfulness meditation session lasted for two hours, including training, experience sharing, and a Q&A session. Participants were also assigned mindfulness practices as homework, including daily breath awareness exercises, maintaining a mindfulness journal, and engaging in mindfulness activities.

## 2.4. Study Procedure

Participants filled out registration forms (including basic information, PHQ-9, and GAD-7) before the experiment.

After screening, they signed informed consent forms to participate in the intervention. The intervention officially began after approximately one week of preparation. PHQ-9 and GAD-7 were administered three days after the fourth and eighth weeks of the mindfulness meditation intervention.

## 2.5. Data Analysis

SPSS 26 was used for statistical analysis. A variance analysis was conducted on the pre-intervention PHQ-9 and GAD-7 scores across the different groups. A paired t-test was performed to analyze the impact of both online and offline mindfulness meditation interventions on depression and anxiety levels.

## 3. Results

### 3.1. Baseline Comparison Before Intervention

In this study, a variance analysis was conducted on the pre-intervention PHQ-9 and GAD-7 scores among the control group (n=24), the online group (n=20), and the offline group (n=21). The results showed that the mean PHQ-9 scores for the control group, online group, and offline group were  $7.75 \pm 3.14$ ,  $7.70 \pm 3.08$ , and  $8.14 \pm 3.21$ , respectively ( $F = 0.125$ ,  $p = 0.882$ ). The GAD-7 scores were  $8.63 \pm 3.12$ ,  $8.85 \pm 2.56$ , and  $9.19 \pm 3.56$ , respectively ( $F = 0.186$ ,  $p = 0.831$ ). These results indicate that there were no significant differences in the depression and anxiety levels among the groups before the intervention, as shown in Table 1. This suggests that the participants had similar baseline psychological states, providing a foundation for evaluating the effectiveness of the intervention.

**Table 1.** Variance Analysis Results

Group (Mean ± SD)	Control Group (n=24)	Online Group (n=20)	Offline Group (n=21)	F	p
PHQ-9 (Pre-intervention)	$7.75 \pm 3.14$	$7.70 \pm 3.08$	$8.14 \pm 3.21$	0.125	0.882
GAD-7 (Pre-intervention)	$8.63 \pm 3.12$	$8.85 \pm 2.56$	$9.19 \pm 3.56$	0.186	0.831

### 3.2. Intervention Effects in Offline Group

For the offline group, paired t-tests showed a significant reduction in PHQ-9 scores after 4 weeks of intervention, from  $8.14 \pm 3.21$  to  $6.86 \pm 3.54$  (difference = 1.29,  $t = 3.792$ ,  $p = 0.001$ ). After 8 weeks, the PHQ-9 scores further decreased to  $5.38 \pm 3.15$  (difference = 1.48,  $t = 3.037$ ,  $p = 0.007$ ), indicating a continuous improvement in depression levels. Similarly, GAD-7 scores in the offline group decreased from  $9.19 \pm 3.56$  to  $7.76 \pm 4.05$  after 4 weeks (difference = 1.43,  $t = 2.855$ ,  $p = 0.010$ ) and further decreased to  $6.29 \pm 3.74$  after 8 weeks (difference = 1.48,  $t = 3.636$ ,  $p = 0.002$ ), demonstrating significant and sustained improvement in anxiety levels, as shown in Table 2.

**Table 2.** Paired t-test Results for Offline Group

Measurement	Pair 1 (Mean ± SD)	Pair 2 (Mean ± SD)	Difference	t	p
PHQ-9 (Pre- vs 4 weeks)	$8.14 \pm 3.21$	$6.86 \pm 3.54$	1.29	3.792	0.001**
PHQ-9 (4 weeks vs 8 weeks)	$6.86 \pm 3.54$	$5.38 \pm 3.15$	1.48	3.037	0.007**
GAD-7 (Pre- vs 4 weeks)	$9.19 \pm 3.56$	$7.76 \pm 4.05$	1.43	2.855	0.010**
GAD-7 (4 weeks vs 8 weeks)	$7.76 \pm 4.05$	$6.29 \pm 3.74$	1.48	3.636	0.002**

### 3.3. Intervention Effects in Online Group

For the online group, paired t-tests showed significant reductions in PHQ-9 scores after 4 weeks (from  $7.70 \pm 3.08$  to  $7.05 \pm 3.25$ , difference = 0.65,  $t = 2.221$ ,  $p = 0.039$ ) and after 8 weeks (from  $7.05 \pm 3.25$  to  $6.10 \pm 3.64$ , difference =

$0.95$ ,  $t = 2.334$ ,  $p = 0.031$ ). GAD-7 scores also significantly improved after 4 weeks (from  $8.85 \pm 2.56$  to  $7.75 \pm 3.02$ , difference = 1.10,  $t = 2.643$ ,  $p = 0.016$ ), although the change after 8 weeks was not statistically significant (from  $7.75 \pm 3.02$  to  $6.90 \pm 3.23$ , difference = 0.85,  $t = 1.461$ ,  $p = 0.160$ ).

**Table 3.** Paired t-test Results for Online Group

Measurement	Pair 1 (Mean $\pm$ SD)	Pair 2 (Mean $\pm$ SD)	Difference	t	p
PHQ-9 (Pre vs 4 weeks)	$7.70 \pm 3.08$	$7.05 \pm 3.25$	0.65	2.221	0.039*
PHQ-9 (4 weeks vs 8 weeks)	$7.05 \pm 3.25$	$6.10 \pm 3.64$	0.95	2.334	0.031*
GAD-7 (Pre vs 4 weeks)	$8.85 \pm 2.56$	$7.75 \pm 3.02$	1.10	2.643	0.016*
GAD-7 (4 weeks vs 8 weeks)	$7.75 \pm 3.02$	$6.90 \pm 3.23$	0.85	1.461	0.160

### 3.4. Comparison of Online and Offline Intervention Effects

Based on the results of the paired t-tests, we compared the effects of online and offline mindfulness interventions on the PHQ-9 and GAD-7 scores.

#### PHQ-9 Scores (Depression)

In the offline intervention group, the pre-intervention PHQ-9 score was  $8.14 \pm 3.21$ , which significantly decreased to  $6.86 \pm 3.54$  after 4 weeks of intervention (difference = 1.29,  $t = 3.792$ ,  $p = 0.001$ ), and further decreased to  $5.38 \pm 3.15$  after 8 weeks (difference = 1.48,  $t = 3.037$ ,  $p = 0.007$ ). This shows that the offline intervention led to a sustained and significant improvement in depression levels.

In the online intervention group, the pre-intervention PHQ-9 score was  $7.70 \pm 3.08$ , which decreased to  $7.05 \pm 3.25$  after 4 weeks (difference = 0.65,  $t = 2.221$ ,  $p = 0.039$ ), and further dropped to  $6.10 \pm 3.64$  after 8 weeks (difference = 0.95,  $t = 2.334$ ,  $p = 0.031$ ). Although the online intervention also showed significant improvement, the final score ( $6.10 \pm 3.64$ ) was higher than that of the offline group ( $5.38 \pm 3.15$ ), suggesting that the offline intervention was more effective in improving depression.

#### GAD-7 Scores (Anxiety)

In the offline intervention group, the pre-intervention GAD-7 score was  $9.19 \pm 3.56$ , which decreased to  $7.76 \pm 4.05$  after 4 weeks (difference = 1.43,  $t = 2.855$ ,  $p = 0.010$ ), and further dropped to  $6.29 \pm 3.74$  after 8 weeks (difference = 1.48,  $t = 3.636$ ,  $p = 0.002$ ), showing sustained improvement in anxiety levels.

In the online intervention group, the pre-intervention GAD-7 score was  $8.85 \pm 2.56$ , which decreased to  $7.75 \pm 3.02$  after 4 weeks (difference = 1.10,  $t = 2.643$ ,  $p = 0.016$ ). However, the score after 8 weeks was  $6.90 \pm 3.23$  (difference = 0.85,  $t = 1.461$ ,  $p = 0.160$ ), not reaching statistical significance. This indicates that while the online intervention had an initial significant effect on reducing anxiety, the long-term effect was less stable compared to the offline intervention.

## 4. Discussion

The results of this study not only support the positive effects of mindfulness meditation in reducing depression and anxiety among university students, but also reveal the differences between online and offline intervention methods, as well as their respective strengths and limitations. By delving into these differences, we can explore these findings

from multiple perspectives and offer valuable insights for future psychological interventions.

First, regarding the impact of mindfulness meditation on depressive symptoms, the offline group showed a more significant improvement. This may be due to the psychological support and sense of interaction provided in offline environments. In offline interventions, participants not only receive immediate feedback from instructors through face-to-face interactions, but they also benefit from the mutual support of group members, enhancing their psychological sense of safety. Studies have shown that social support is a critical factor in psychological interventions. Especially when dealing with mental health issues, good social interactions and emotional support can enhance the effectiveness of the intervention. In contrast, although online interventions offer technical convenience, the lack of face-to-face interaction results in weaker social support, which may lead to decreased focus during meditation, affecting the effectiveness of the intervention. Therefore, future designs of internet-based mindfulness meditation interventions could consider increasing opportunities for group discussions and fostering deeper exchanges among group members to enhance participants' engagement and motivation. Through more interactive exchanges, participants can better share their meditation experiences and provide mutual support, thus further improving the effectiveness of the intervention.

Second, regarding the improvement in anxiety, the offline group maintained significant effects in the later stages of the intervention, while the online group's improvement in anxiety scores plateaued. This phenomenon may be related to the nature of anxiety itself. Anxiety is often accompanied by heightened physiological arousal and psychological reactions. Without face-to-face guidance and on-site supervision, it may be difficult for participants to maintain the calm and focused state required for mindfulness meditation. The technical limitations of online interventions, such as unstable internet connections and environmental distractions, may also further weaken the effects of the intervention. Future research could explore how to optimize online intervention platforms to improve stability and interactivity, thus maintaining the effectiveness of the intervention over a longer period.

Third, the results of this study also highlight the potential of online interventions in improving depressive symptoms. Although the effects were not as strong as offline interventions, they still showed a significant improvement, providing a viable option for individuals who cannot participate in offline interventions. With the proliferation of

mobile devices and the internet, internet-based psychological interventions offer greater accessibility and convenience, especially for students who cannot access offline services due to geographical, time, or other constraints. The flexibility of online interventions allows participants to engage in meditation exercises according to their own schedules, reducing the dependency on fixed times and locations. This opens up new directions for future mental health services: how to expand the coverage of psychological interventions through internet technology while ensuring their effectiveness, enabling more individuals in need to benefit.

Moreover, it is important to note that online interventions can overcome the limitation of fixed group sizes in mindfulness training. Leveraging the convenience of the internet, this approach has significant potential for widespread promotion among university students[17]. The flexibility and operability of online interventions allow participants to practice mindfulness according to their schedules, reducing the need for fixed time and location constraints. This opens up new directions for future mental health services: how to expand the coverage of psychological interventions using internet technology while ensuring their effectiveness, enabling more individuals in need to benefit. This also raises a new question for future research: how to balance the flexibility of online interventions with the social support effect of offline interventions, and how to maximize the effectiveness of interventions through a combination of both. For example, future designs could consider a hybrid intervention model, where offline mindfulness meditation is used initially to help participants establish stable practice habits, followed by online platforms for continuous follow-up and support. This "blended" intervention model may compensate for the lack of social support in online interventions while retaining their flexibility and convenience.

Lastly, the results of this study provide important insights for future research on mindfulness meditation interventions. Whether delivered online or offline, mindfulness meditation significantly improved anxiety and depression among university students, providing empirical support for its broad application in the field of student mental health. Future research can build on this foundation to further explore how to optimize the design of mindfulness interventions, especially in developing more personalized, flexible, and effective mental health interventions tailored to the specific needs of different individuals and contexts. Additionally, as technology continues to develop, internet-based mindfulness meditation interventions are likely to become an important supplement in the mental health field, providing psychological support and emotional regulation tools to a broader audience of students..

## 5. Conclusion

This study, by comparing the effects of online and offline mindfulness meditation interventions on depression and anxiety among university students, confirmed the positive role of mindfulness meditation in alleviating psychological issues. The results showed that both online and offline interventions significantly reduced depression and anxiety, with offline interventions demonstrating more sustained effects, particularly in anxiety reduction. Although the improvement from online interventions was slightly lower, the flexibility and accessibility of online interventions provide an effective alternative for individuals who cannot participate in offline sessions. This study offers empirical

support for designing future mindfulness meditation interventions for university students and provides new insights into the application of mental health services in an internet-based context.

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