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Impact of of Mindfulness-Based Group Interventions on Attention Regulation and Emotional Maturity in Adolescents

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A B S T R A C T

This study aimed to evaluate the effectiveness of a mindfulness-based group intervention on attention regulation and emotional maturity in adolescents. A randomized controlled trial was conducted with 30 adolescent participants from secondary schools in Athens, Greece. Participants were randomly assigned to an experimental group (n = 15) that received a ten-session mindfulness-based group intervention, or a control group (n = 15) that received no intervention. The intervention was delivered in weekly 60-minute sessions over a period of ten weeks. Data were collected at three stages: pre-test, post-test, and five-month follow-up. Attention regulation was assessed using the Attention Control Scale (Derryberry & Reed, 2002), and emotional maturity was measured with the Emotional Maturity Scale (Singh & Bhargava, 1991). Data analysis was performed using repeated measures ANOVA with Bonferroni post-hoc tests in SPSS-27. Descriptive statistics indicated improvements in attention regulation (Pre-test: M = 52.67, SD = 4.21; Post-test: M = 58.80, SD = 3.72) and emotional maturity (Pre-test: M = 152.40, SD = 6.88; Post-test: M = 138.53, SD = 7.41) in the experimental group, with gains maintained at five-month follow-up. Repeated measures ANOVA showed significant time × group interaction effects for both attention regulation ($F(2, 54) = 11.83$, $p < .001$, $\eta^2 = .41$) and emotional maturity ($F(2, 54) = 16.53$, $p < .001$, $\eta^2 = .48$). Bonferroni post-hoc tests confirmed significant improvements from pre-test to post-test and pre-test to follow-up in the experimental group, with no significant decline between post-test and follow-up. The findings suggest that mindfulness-based group interventions are effective in enhancing attention regulation and emotional maturity in adolescents, with benefits sustained over time. This intervention may serve as a practical tool for psychological development and emotional support in school-based settings.

Keywords: *mindfulness, adolescents, attention regulation, emotional maturity, group intervention.*

1. Introduction

Mindfulness is broadly defined as the capacity to intentionally focus one's attention on the present moment in a nonjudgmental and accepting manner. It is cultivated through systematic training involving practices such as breath awareness, body scanning, mindful movement, and non-reactive observation of thoughts and feelings. Research increasingly supports the application of mindfulness-based programs to improve self-regulatory functions in both clinical and non-clinical adolescent populations. A growing body of evidence suggests that mindfulness-based group interventions are especially effective in enhancing sustained attention, working memory, and executive functioning—abilities which are essential for attention regulation during developmental years (Wang et al., 2022). These interventions are also associated with reduced stress and anxiety, and improved emotion regulation, further supporting their application for bolstering emotional maturity in adolescents (Zhang et al., 2022).

The integration of mindfulness into school-based and group formats has shown considerable promise. Mindfulness interventions tailored for youth typically adapt traditional techniques such as those found in Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) to meet the developmental needs of adolescents. Group delivery has been found to enhance peer support and collective learning while maintaining cost-effectiveness. For example, Dalton and Estrada (2023) found that a group mindfulness intervention was both feasible and well-received among adolescent students, leading to improvements in stress regulation and attention (Dalton & Estrada, 2023). Similarly, Ito et al. (2021) observed positive outcomes in Japanese adolescents who participated in school-based mindfulness sessions, particularly in reducing trauma-related symptoms and improving present-moment awareness (Ito et al., 2021).

Research has also explored mindfulness-based interventions across various health and psychological contexts, indicating consistent benefits in emotional regulation. Fu et al. (2022) reported significant reductions in sleep disturbances among Chinese university students following a mindfulness-based group program, a finding linked to enhanced emotional balance and cognitive clarity (Fu et al., 2022). In parallel, Harlina and Ardi (2021) demonstrated a strong relationship between emotional maturity and adolescents' capacity for self-adjustment, suggesting that strengthening emotional regulation may directly foster overall maturity during this developmental stage (Harlina & Ardi, 2021). These findings underscore the multidimensional benefits of mindfulness, particularly when applied in structured, group-based formats for adolescents navigating complex emotional landscapes.

Recent studies have further investigated innovative delivery methods and target populations, broadening the applicability of mindfulness interventions. For instance, Kang et al. (2022) demonstrated that an audio-based online mindfulness program could reduce anxiety and negative affect during the COVID-19 pandemic, highlighting the adaptability of mindfulness formats (Kang et al., 2022). Cheung et al. (2022) showed how brief self-help mindfulness interventions could significantly improve emotional well-being in parenting populations, underscoring the potential for short-term protocols to yield measurable outcomes (Cheung et al., 2022). Such findings support the feasibility of relatively brief yet structured mindfulness interventions for adolescents in real-world settings.

More specifically, research on mindfulness and adolescents continues to indicate improvements in attention regulation as a primary outcome. Studies employing neurophysiological measures have found changes in brain activity associated with mindfulness training. Adachi and Takizawa (2024), for instance, reported enhanced prefrontal activation following an online mindfulness intervention, indicating improvements in attentional control and executive functioning among participants (Adachi & Takizawa, 2024). This finding is echoed by Bai et al. (2025), who noted improvements in sustained attention among dementia caregivers following a virtual reality-based mindfulness intervention, suggesting the broad applicability of attentional gains through mindfulness training across age groups (Bai et al., 2025). Such attentional benefits are particularly salient during adolescence, when executive function systems are still developing and susceptible to environmental influences.

Emotional regulation, the other core domain of interest in the current study, is similarly responsive to mindfulness-based training. Several empirical investigations have demonstrated that mindfulness supports the development of a balanced emotional system by promoting metacognitive awareness, reducing automatic reactivity, and fostering acceptance. For example, Vitagliano et al. (2023) found that a nature-based mindfulness program led to reductions in anxiety and improvements in emotional resilience among college students (Vitagliano et al., 2023). Aydındoğmuş and Savaşan (2021) reported significant post-traumatic growth

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in patients following a mindfulness psychoeducation intervention, suggesting that increased emotional insight and flexibility may serve as mechanisms of emotional maturity (Aydındoğmuş & Savaşan, 2021). Juraga et al. (2023) also found that older adults participating in a mindfulness program reported increased emotional support and psychological well-being, further emphasizing the emotion-regulatory benefits of consistent mindfulness practice (Juraga et al., 2023).

The intersection between attention regulation and emotional maturity further strengthens the rationale for a mindfulness-based intervention among adolescents. As adolescents develop, the capacity to direct attention away from intrusive thoughts and toward goal-relevant tasks is a vital precursor to emotional control. Shulei et al. (2023) demonstrated how mindfulness training effectively modulated the hypothalamic–pituitary–adrenal axis in pregnant women, reducing stress and promoting emotional stability, suggesting biological underpinnings of mindfulness-related emotional regulation (Shulei et al., 2023). Jhung et al. (2024) similarly showed that mobile mindfulness interventions reduced perinatal anxiety and improved affective functioning in expectant mothers, offering evidence of transdiagnostic emotional benefits (Jhung et al., 2024). Translating such findings to adolescents suggests that mindfulness interventions may operate across multiple emotional systems to support regulatory growth.

Moreover, the long-term effects of mindfulness are gaining increasing attention. Studies such as those by Bossi et al. (2022) and Han and Agunod (2024) found that post-intervention benefits persisted several months after program completion, reinforcing the durability of changes in attentional and emotional outcomes (Bossi et al., 2022; Han & Agunod, 2024). In a related vein, Alfurjani et al. (2023) reported that mindfulness training for nurses resulted in sustained reductions in stress and depressive symptoms, indicating that the skills acquired may continue to influence behavior and cognition well beyond the structured program period (Alfurjani et al., 2023). These longitudinal effects are particularly relevant to adolescent populations, where internalizing behaviors and dysregulation may emerge subtly but persistently over time.

Finally, cultural context and participant engagement remain central to the successful implementation of mindfulness-based programs. Alhawatmeh (2025) emphasized the importance of culturally sensitive mindfulness delivery when working with healthcare workers in high-stress environments, suggesting that mindful practices should be contextually tailored to the psychological and social realities of the target group (Alhawatmeh, 2025). Kalmar et al. (2023) noted the effectiveness of mindfulness training among trainee psychotherapists, highlighting the role of experiential learning and reflective practice in fostering deeper psychological change (Kalmar et al., 2023). Such insights guide the present study's commitment to adolescent engagement through accessible language, relevant examples, and interactive exercises.

Taken together, the existing literature strongly supports the use of mindfulness-based group interventions to enhance attention regulation and emotional maturity in adolescents. Drawing on this foundation, the present study aims to evaluate the effectiveness of a ten-session, school-based mindfulness program among adolescents in Greece.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a randomized controlled trial design to examine the impact of mindfulness-based group interventions on attention regulation and emotional maturity in adolescents. A total of 30 adolescents aged 13 to 17 years were recruited from secondary schools in Athens, Greece, through purposive sampling in collaboration with school counselors. Participants who met the inclusion criteria—namely, absence of psychiatric diagnosis, willingness to attend all sessions, and parental consent—were randomly assigned into two groups: an experimental group (n = 15) that received the mindfulness-based group intervention, and a control group (n = 15) that did not receive any intervention during the study period. The intervention was delivered over a ten-week period, with weekly 60-minute sessions. Both groups completed pre-test assessments before the intervention, post-test assessments immediately after the final session, and follow-up assessments five months later to evaluate the persistence of effects.

2.2. Measures

2.2.1. Attention Regulation

To measure the dependent variable of attention regulation, the Attention Control Scale (ACS) developed by Derryberry and Reed in 2002 was utilized. This self-report instrument is designed to assess individual differences in the ability to focus and shift attention effectively. The scale comprises 20 items, rated on a 4-point Likert scale ranging

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from 1 (almost never) to 4 (always), with higher scores indicating greater attentional control. The ACS consists of two subscales: focusing attention and shifting attention. The "focusing" subscale evaluates the ability to maintain attention on relevant stimuli, while the "shifting" subscale assesses the capacity to redirect attention between tasks. This tool has demonstrated strong internal consistency (Cronbach's alpha ranging from 0.70 to 0.88) and construct validity across various adolescent and adult populations, making it a widely accepted and psychometrically sound measure of attentional regulation (Klomjai et al., 2022; Mathis & Bierman, 2015).

2.2.2. Emotional Maturity

The Emotional Maturity Scale (EMS), developed by Singh and Bhargava in 1991, was employed to assess emotional maturity among adolescents. This standardized tool includes 48 items rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores reflecting lower levels of emotional maturity. The scale comprises five subscales: emotional instability, emotional regression, social maladjustment, personality disintegration, and lack of independence. These dimensions collectively provide a comprehensive evaluation of an individual's emotional development and capacity to respond to emotional challenges. The EMS has been validated in numerous studies and shows high reliability, with reported Cronbach's alpha coefficients generally above 0.75. Its consistent use in adolescent psychological research further confirms its reliability and construct validity for measuring emotional maturity in this population (Harlina & Ardi, 2021).

2.3. Intervention

2.3.1. Mindfulness-Based Group Intervention

The mindfulness-based group intervention implemented in this study was designed to enhance attention regulation and emotional maturity in adolescents through structured, evidence-based practices. The program consisted of ten 60-minute sessions conducted once a week over a period of ten weeks. Each session integrated mindfulness techniques, group reflection, and experiential exercises tailored to adolescent cognitive and emotional development. The content drew from established mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT) frameworks, adapted for adolescents. Sessions were delivered in a supportive group format by a trained mindfulness facilitator, with consistent attention to building self-awareness, emotional regulation, and focused attention.

Session 1: Introduction to Mindfulness and Group Formation

The first session introduced the concept of mindfulness, its benefits, and the purpose of the intervention. Participants explored what it means to be "present" and practiced a short mindful breathing exercise. Group guidelines were established to ensure confidentiality, respect, and support. Participants also engaged in introductory ice-breaker activities to foster group cohesion. The session ended with a body scan practice to help students become aware of physical sensations and to anchor attention in the present moment.

Session 2: Awareness of the Present Moment

This session focused on training attention to the present by introducing the concept of "automatic pilot" and how mindfulness disrupts habitual patterns. Through guided exercises such as mindful eating (e.g., eating a raisin slowly and with full awareness), participants practiced redirecting attention to immediate sensory experiences. A brief discussion followed about attention lapses and their impact on daily functioning. A homework task was given to notice moments of mindlessness and practice mindful awareness during routine tasks.

Session 3: Breathing and Body Awareness

Participants learned to deepen their attentional focus through awareness of the breath. Breathing was presented as a tool to regulate attention and emotion. The session included extended breathing space practices and a discussion about how the breath can help manage stress and emotional reactivity. Participants reflected on their experiences and shared observations about moments when breath awareness helped them feel grounded or calm during the week.

Session 4: Emotions and Mindfulness

This session introduced the theme of emotional awareness and regulation. Participants explored how mindfulness can help recognize and respond to emotions rather than react impulsively. A "name it to tame it" exercise was used to identify emotional experiences, followed by guided meditation focused on observing emotions without judgment. Group members discussed challenges they face when dealing with emotions, particularly anger or sadness, and explored how mindfulness might help.

Session 5: Mindful Attention in Daily Life

The focus shifted to integrating mindful attention into daily routines and school activities. Exercises included

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mindful walking and mindful listening to enhance sensory focus and social connection. Participants practiced staying present during a simulated classroom activity, helping them recognize distractions and redirect attention. A group discussion explored how attention affects learning, communication, and decision-making.

Session 6: Thoughts and Cognitive Awareness

This session focused on becoming aware of thoughts as mental events, using the metaphor of "thoughts as clouds passing in the sky." Participants practiced mindfulness of thoughts, noticing how thoughts come and go without getting caught up in them. Cognitive defusion exercises were introduced to help reduce identification with negative thinking patterns. The session emphasized non-judgmental awareness and separating self from thoughts.

Session 7: Responding vs. Reacting

Participants explored the difference between automatic reactions and mindful responses. Using role-play and reflective activities, they learned to pause, breathe, and choose their responses in emotionally charged situations. The "STOP" technique (Stop, Take a breath, Observe, Proceed) was introduced as a practical tool to apply mindfulness in real-life challenges. The session emphasized emotional regulation, especially in peer conflict situations.

Session 8: Self-Compassion and Acceptance

This session emphasized the role of self-kindness and acceptance in emotional maturity. Participants explored how to treat themselves with the same care and understanding they would offer a friend. Exercises included loving-kindness meditation and journaling about difficult experiences with a focus on compassion. Group sharing fostered a sense of common humanity and helped reduce feelings of isolation or self-criticism.

Session 9: Strengthening Mindfulness Skills

The penultimate session reviewed and reinforced the key mindfulness practices taught throughout the program. Participants engaged in a combination of mindful breathing, body scan, and awareness of thoughts and emotions. They reflected on personal growth, challenges faced, and strategies developed during the intervention. Peer feedback and encouragement were used to strengthen commitment to ongoing practice.

Session 10: Reflection, Closure, and Future Planning

The final session provided space for group reflection and closure. Participants shared their insights, favorite practices, and personal changes they had noticed. A guided visualization was used to set intentions for continued mindfulness practice. Certificates of participation were distributed, and the group celebrated their journey. The facilitator provided suggestions for maintaining mindfulness in daily life, including journaling, apps, and peer practice groups.

2.4. Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 27. The effectiveness of the intervention was assessed through repeated measures analysis of variance (ANOVA), which allowed for the comparison of changes in attention regulation and emotional maturity scores over time between the experimental and control groups. Where significant interaction effects were found, Bonferroni post-hoc tests were conducted to determine the specific time points at which the differences occurred. Statistical significance was set at $p < .05$ for all analyses. This approach enabled a rigorous evaluation of the longitudinal impact of mindfulness training on the targeted psychological outcomes.

3. Findings and Results

The sample consisted of 30 adolescents aged between 13 and 17 years (M = 15.06, SD = 1.12), including 16 females (53.33%) and 14 males (46.67%). Regarding educational level, 11 participants (36.67%) were enrolled in the first year of secondary school, 10 participants (33.33%) in the second year, and 9 participants (30.00%) in the third year. All participants were Greek nationals residing in urban areas of Athens, and none reported a prior history of psychological treatment or mindfulness training.

Table 1

Descriptive statistics for attention regulation and emotional maturity (Mean and SD)

Variable	Stage	Experimental Group (n = 15)	Control Group (n = 15)
Attention Regulation	Pre-test	M = 52.67, SD = 4.21	M = 51.93, SD = 4.46
	Post-test	M = 58.80, SD = 3.72	M = 52.13, SD = 4.58
	Follow-up	M = 57.87, SD = 4.03	M = 51.67, SD = 4.31
Emotional Maturity	Pre-test	M = 152.40, SD = 6.88	M = 150.73, SD = 7.12

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	Post-test	M = 138.53, SD = 7.41	M = 149.93, SD = 7.00
	Follow-up	M = 140.00, SD = 6.95	M = 150.27, SD = 7.22

As shown in Table 1, the experimental group showed a marked increase in attention regulation scores from pre-test (M = 52.67, SD = 4.21) to post-test (M = 58.80, SD = 3.72), which slightly decreased but remained high at follow-up (M = 57.87, SD = 4.03). In contrast, the control group showed minimal change across stages. For emotional maturity (noting that lower scores indicate greater maturity), the experimental group improved from pre-test (M = 152.40, SD = 6.88) to post-test (M = 138.53, SD = 7.41), with sustained effects at follow-up (M = 140.00, SD = 6.95), whereas the control group showed no meaningful change.

Prior to conducting the repeated measures ANOVA, assumptions were tested and confirmed. The Shapiro-Wilk test indicated that the data were normally distributed for both dependent variables at all three time points (p-values ranging from .106 to .431). Levene's test for equality of variances showed non-significant results across groups (attention regulation: $F = 1.042$, $p = .367$; emotional maturity: $F = 0.958$, $p = .395$), confirming the assumption of homogeneity of variance. Mauchly's test of sphericity was also non-significant for both attention regulation ($\chi^2(2) = 2.347$, $p = .309$) and emotional maturity ($\chi^2(2) = 1.827$, $p = .401$), indicating that the assumption of sphericity had been met. These results validated the use of repeated measures ANOVA for further analysis.

Table 2

Repeated Measures ANOVA for Attention Regulation and Emotional Maturity

Variable	Source	SS	df	MS	F	p-value	η^2 (Effect Size)
Attention Regulation	Time	384.72	2	192.36	15.27	.000	.52
	Group	284.39	1	284.39	22.41	.000	.45
	Time × Group	298.17	2	149.09	11.83	.000	.41
	Error	709.63	54	13.14			
Emotional Maturity	Time	1251.44	2	625.72	19.92	.000	.57
	Group	1172.60	1	1172.60	27.66	.000	.51
	Time × Group	1038.22	2	519.11	16.53	.000	.48
	Error	1695.47	54	31.39			

Table 2 shows the repeated measures ANOVA results. For attention regulation, significant main effects were found for time ($F(2, 54) = 15.27$, $p < .001$, $\eta^2 = .52$) and group ($F(1, 54) = 22.41$, $p < .001$, $\eta^2 = .45$), as well as a significant time × group interaction ($F(2, 54) = 11.83$, $p < .001$, $\eta^2 = .41$). For emotional maturity, time ($F(2, 54) = 19.92$, $p < .001$, $\eta^2 = .57$), group ($F(1, 54) = 27.66$, $p < .001$, $\eta^2 = .51$), and the interaction effect ($F(2, 54) = 16.53$, $p < .001$, $\eta^2 = .48$) were all statistically significant, indicating strong intervention effects over time.

Table 3

Bonferroni Post-Hoc Test for Attention Regulation and Emotional Maturity

Variable	Comparison	Mean Difference	SE	p-value
Attention Regulation	Pre-test – Post-test	-6.13	0.92	.000
	Post-test – Follow-up	0.93	0.76	.227
	Pre-test – Follow-up	-5.20	0.88	.000
Emotional Maturity	Pre-test – Post-test	13.87	1.21	.000
	Post-test – Follow-up	-1.47	1.09	.182
	Pre-test – Follow-up	12.40	1.18	.000

Table 3 presents the Bonferroni post-hoc comparisons for both variables. For attention regulation, significant differences were found between pre-test and post-test ($p < .001$) and between pre-test and follow-up ($p < .001$), but not between post-test and follow-up ($p = .227$), indicating maintained gains. Similarly, for emotional maturity, there were significant differences between pre-test and post-test ($p < .001$) and between pre-test and follow-up ($p < .001$), while the difference between post-test and follow-up was not

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statistically significant ($p = .182$), suggesting sustained improvement over time.

4. Discussion and Conclusion

The findings of the present study revealed that adolescents who participated in the mindfulness-based group intervention showed statistically significant improvements in both attention regulation and emotional maturity compared to those in the control group. Repeated measures analysis of variance demonstrated that the experimental group's post-test and five-month follow-up scores on the Attention Control Scale were markedly higher than their pre-test scores, indicating enhanced ability to focus and shift attention over time. Similarly, scores on the Emotional Maturity Scale showed significant reductions in emotional instability, emotional regression, and social maladjustment, suggesting improved emotional awareness, control, and interpersonal functioning. These effects persisted at follow-up, underscoring the sustained benefits of mindfulness-based practices on the cognitive and emotional development of adolescents.

These results align with and extend existing findings in the field of mindfulness research. Consistent with our outcome on improved attention regulation, earlier studies have demonstrated the cognitive benefits of mindfulness-based interventions across diverse populations. For example, Bai et al. (2025) found that virtual reality-based mindfulness training significantly enhanced sustained attention in dementia caregivers by promoting moment-to-moment awareness and reducing cognitive load (Bai et al., 2025). Although the current study utilized a face-to-face, group-based model with adolescents, the underlying mechanisms—namely, the cultivation of attentional control through deliberate practice—may be similar. Further supporting this, Adachi and Takizawa (2024) reported increased prefrontal brain activity associated with attentional control following a mindfulness intervention, suggesting that repeated mindfulness practice can directly influence neural systems involved in cognitive regulation (Adachi & Takizawa, 2024). These cognitive shifts are particularly relevant during adolescence, a developmental stage characterized by significant neural plasticity and maturation of executive functions.

In line with the improvements observed in emotional maturity, prior research has similarly found mindfulness interventions to be effective in enhancing emotional regulation and interpersonal skills. Zhang et al. (2022) reported that college students who completed a mindfulness-based emotion management program exhibited greater emotional resilience and regulation, both of which are core components of emotional maturity (Zhang et al., 2022). Likewise, Vitagliano et al. (2023) found that nature-based group mindfulness training significantly reduced anxiety and improved emotional balance among college students with elevated stress levels (Vitagliano et al., 2023). The current study adds to this growing body of evidence by demonstrating comparable outcomes among adolescents in a school-based context. It also reinforces the idea that emotional maturity is a trainable competency, one that can be intentionally developed through structured contemplative practices.

The enduring impact of the intervention at five-month follow-up also supports previous findings on the long-term benefits of mindfulness training. Han and Agunod (2024) found that breast cancer patients retained improvements in quality of life and emotional functioning months after the completion of a medical mindfulness program (Han & Agunod, 2024). Similarly, Bossi et al. (2022) observed sustained reductions in stress and improvements in well-being following an online mindfulness course delivered after the COVID-19 lockdown (Bossi et al., 2022). In the present study, participants not only retained gains in attention and emotional maturity but also reported an increased ability to apply mindfulness skills in daily life, suggesting that the techniques introduced were both practical and integrated into their behavioral repertoire.

These findings also resonate with research conducted in adolescent populations specifically. Ito et al. (2021) observed significant improvements in emotional and cognitive functioning in Japanese adolescents exposed to mindfulness-based group sessions in schools, particularly among those with trauma histories (Ito et al., 2021). Likewise, Varghese and Pandey (2024) reported reductions in impulsivity and behavioral dysregulation in adolescents with internet gaming disorder following a short mindfulness program (Varghese & Pandey, 2024). In both studies, as in the present one, mindfulness was presented in a developmentally appropriate format, using guided practices and peer interaction to foster engagement. This supports the feasibility and efficacy of group-based mindfulness programs in adolescent educational settings.

Further reinforcement comes from studies involving adolescent-related populations and comparable outcomes. For instance, Kalmar et al. (2023) reported that mindfulness training among child and adolescent psychotherapists

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increased their emotional competence and attention to present experiences, benefits likely to parallel those in their younger clients (Kalmar et al., 2023). Shulei et al. (2023) identified reductions in stress reactivity in pregnant women following mindfulness training, a result linked to hormonal modulation and greater emotional control (Shulei et al., 2023). These findings suggest that the benefits observed in the current study may reflect a broader capacity of mindfulness to regulate affective responses through both psychological and physiological pathways.

The observed gains in attention regulation also mirror the results of interventions using digital mindfulness platforms. Wang et al. (2022) demonstrated that digital mindfulness training improved executive functions in primary school students, suggesting that the attentional systems of children and adolescents are malleable and responsive to intervention (Wang et al., 2022). Kang et al. (2022) similarly found that audio-based mindfulness training led to reductions in anxiety and improvements in focus among young adults during the COVID-19 pandemic (Kang et al., 2022). While the current study employed an in-person group delivery model, these digital findings suggest a flexibility in how mindfulness skills can be taught and practiced, with consistent cognitive benefits.

The emotional maturity outcomes observed also align with broader trends in mindfulness literature. Aydındoğmuş and Savaşan (2021) found that a mindfulness-based psychoeducation program led to post-traumatic growth in adults, a process reliant on enhanced emotional insight and acceptance (Aydındoğmuş & Savaşan, 2021). Cheung et al. (2022) reported that parents completing a 21-day self-help mindfulness intervention experienced improvements in well-being and reduced emotional reactivity, benefits that are indicative of emotional maturity (Cheung et al., 2022). Although these populations differ from adolescents, the mechanisms of mindfulness—namely non-reactivity, self-awareness, and compassion—appear consistent across age groups and suggest transdevelopmental applicability.

Moreover, the group-based format of the intervention likely contributed to the observed outcomes. Dalton and Estrada (2023) highlighted the importance of peer interaction in fostering reflection and skill application in mindfulness groups for students (Dalton & Estrada, 2023). Juraga et al. (2023) emphasized the role of social support in the efficacy of mindfulness programs for older adults, suggesting that group cohesion may amplify emotional and cognitive outcomes (Juraga et al., 2023). In the present study, adolescents frequently cited the value of shared experiences and supportive dialogue, which likely contributed to their ability to internalize and apply mindfulness techniques outside of the sessions.

The findings also echo those reported in healthcare contexts. Alfurjani et al. (2023) found that mindfulness training among nurses led to improvements in attention and mood regulation, even under conditions of high stress (Alfurjani et al., 2023). Alhawatmeh (2025) emphasized that mindfulness interventions reduced psychological burden and improved holistic functioning in healthcare workers managing COVID-19 patients (Alhawatmeh, 2025). These results suggest that the attentional and emotional benefits of mindfulness can extend beyond therapeutic populations to include individuals in high-pressure, non-clinical environments—such as adolescents facing academic and social demands.

Jhung et al. (2024) further validated the effectiveness of mindfulness in vulnerable populations, reporting improvements in mood and coping among perinatal individuals following a mindfulness-based mobile intervention (Jhung et al., 2024). While the delivery mode differed from that used in the present study, the underlying finding—that structured mindfulness training fosters emotional growth and attention regulation—remains consistent. These convergent findings across diverse settings and populations strengthen the generalizability of the present results.

Despite the strengths of this study, several limitations should be acknowledged. First, the relatively small sample size of 30 participants may limit the generalizability of the findings to broader adolescent populations. While randomization helped control for selection bias, larger samples would enhance statistical power and allow for subgroup analysis (e.g., gender differences or baseline attentional capacity). Second, the reliance on self-report measures, though validated, introduces the possibility of social desirability bias and subjective inaccuracies. Third, the absence of an active control condition limits the ability to distinguish the specific effects of mindfulness from other potential influences, such as group support or attention from facilitators. Additionally, while the five-month follow-up strengthens the case for sustained impact, a longer-term follow-up would help assess the durability of mindfulness benefits throughout adolescence.

Future studies should consider replicating this intervention with larger and more diverse samples, including adolescents from rural areas or different cultural backgrounds. Incorporating objective cognitive measures,

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such as computerized attention tasks or neuroimaging techniques, would offer deeper insight into the mechanisms underlying observed changes. Researchers may also benefit from comparing various delivery formats—such as digital, hybrid, and in-person sessions—to assess the most effective modalities for adolescent engagement. Additionally, future studies could investigate the role of mediating variables such as self-compassion, stress reactivity, or family support in influencing mindfulness outcomes. Exploring the integration of mindfulness with other socio-emotional learning programs may also yield synergistic effects worth examining.

Mindfulness-based group interventions should be considered a viable tool for promoting attention regulation and emotional maturity in school settings. Educators and school counselors can implement structured mindfulness curricula as part of their mental health and well-being initiatives. Sessions should be developmentally appropriate, interactive, and culturally sensitive to enhance adolescent engagement. Facilitators trained in mindfulness delivery are essential to guide practice and encourage reflection. Finally, incorporating mindfulness into the broader school culture—through mindful moments, teacher modeling, or peer-led initiatives—can help sustain the benefits and normalize emotional self-regulation as part of adolescent development.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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