



The Effectiveness of a Mindfulness-Based Cognitive Therapy Training Program on Executive Functions and Sustained Attention in Children with Learning Disorders

Batool Zare ¹, Reza Ali Tarkhan ^{2*}, Sana Najafi ³

1. Department of Psychology, Faculty of Psychology and Educational Sciences, University of Tehran, Tehran, Iran.

2. Department of Educational Sciences, Faculty of Educational Sciences, University of Shahed, Tehran, Iran.

3. Department of Educational Psychology, Faculty of Psychology and Educational Sciences, University of Tehran, Tehran, Iran.

***Corresponding Author:** Assistant Professor, Department of Educational Sciences, Faculty of Educational Sciences, University of Shahed, Tehran, Iran. Email: r.tarkhan@shahed.ac.ir

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ABSTRACT

Executive function deficits are among the most common cognitive difficulties experienced by children with learning disorders and are associated with poor academic achievement, impaired emotional regulation, and difficulties in everyday functioning. Mindfulness-Based Cognitive Therapy (MBCT) has been proposed as a promising intervention for improving cognitive and emotional functioning in this population. Therefore, the present study investigated the effectiveness of an MBCT training program on executive functions and sustained attention in children with learning disorders. A quasi-experimental pretest-posttest design with a control group was employed. Thirty children aged 9–12 years diagnosed with learning disorders were selected from the Learning Disorders Clinic of the Faculty of Psychology and Educational Sciences, University of Tehran, and randomly assigned to an experimental group ($n = 15$) or a control group ($n = 15$). The experimental group participated in twelve weekly 90-minute MBCT sessions, whereas the control group received no intervention. Data were collected using the Executive Skills Questionnaire-Revised (ESQ-R) and the Integrated Visual and Auditory Continuous Performance Test (IVA) and analyzed using multivariate analysis of covariance (MANCOVA). The findings indicated that MBCT significantly improved planning, emotional regulation, and time management compared with the control group. However, no significant effects were found for organization, behavioral regulation, or sustained attention. These findings suggest that MBCT is an effective intervention for enhancing specific components of executive functioning in children with learning disorders. Incorporating mindfulness-based interventions into educational and clinical settings may strengthen self-regulatory and cognitive abilities, thereby improving academic performance and psychological functioning in this population.

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Introduction

Executive functions play a crucial role in the development and expansion of children's academic and social abilities and are of particular importance in their academic and social readiness for school entry (Bünger et al, 2021). Research findings have demonstrated that cognitive abilities associated with executive functions can predict and contribute to adaptive behaviors. Accordingly, executive functions play a significant role in information processing, everyday life skills, and effective self-maintenance (Bernardi et al, 2018). These functions are considered fundamental skills for individuals' mental and physical well-being, and impairments in these abilities may lead to behavioral and psychological problems as well as difficulties in performing daily activities (Dayan et al, 2007). In fact, executive functions encompass abilities such as decision-making, strategic planning, attention, self-initiation, impulse control, working memory, cognitive flexibility, response inhibition, and academic performance (Amani, 2017).

Attention, as one of the most important components of executive functions, plays a vital role in information processing and in the selection of relevant data for analyzing and responding to the environment (Bünger et al, 2021). Sustained attention, which is a subtype of attention, refers to the ability to maintain focus over time and is considered the most fundamental level of attention. Since other forms of attention also depend on sustained attention, any impairment in this component may indicate deficiencies in other types of attentional functioning (Jalilvand, 2020).

Mindfulness-Based Cognitive Therapy (MBCT), originally introduced by Segal et al (2012) for the prevention of depressive relapse, is a combination of cognitive approaches and meditation techniques aimed at teaching individuals how to regulate attention in order to recognize mood changes and prevent the recurrence of symptoms (Sipe, & Eisendrath, 2012). MBCT, through the use of cognitive-behavioral and metacognitive strategies, emphasizes attentional focus and can prevent the development of negative mood states, maladaptive thoughts, and worry-related responses while facilitating the formation of new perspectives and the experience of positive emotions (Segal et al., 2012). This therapeutic approach teaches individuals to accept their emotions, live in the present moment, and enhance their resilience (Hayes et al, 2006). Furthermore, it enables individuals to relate differently to challenging physical and emotional states, utilize healthier coping strategies, identify the underlying causes of maladaptive behaviors, and disengage from previous dysfunctional patterns. In addition, this approach promotes the acquisition of practical skills for coping with everyday challenges (Bowen et al., 2021).

In the field of learning disorders, particular attention has been given to the role of executive functions, especially sustained attention. For example, Kiani et al (2021) investigated the effectiveness of a mindfulness-based cognitive empowerment program on improving executive functions in children with Attention-Deficit/Hyperactivity Disorder (ADHD). Their findings indicated that the program led to improvements in various components of executive functioning. Similarly, Huguet et al (2017) reported that mindfulness-based practices could enhance concentration and attention in children with internalizing behavioral disorders. In addition, Schoenberg & Speckens (2014) emphasized that the use of mindfulness techniques may improve executive functions by enhancing the functioning of the prefrontal cortex. Collectively, these studies highlight the positive effects of mindfulness-based programs on improving executive functions and sustained attention in children with learning disorders, suggesting that such interventions may serve as effective strategies for enhancing the cognitive capacities of these children.

Given the importance of executive functions in the learning process and academic achievement, the assessment and enhancement of these functions may have substantial effects on the cognitive, emotional, and social capacities of children. Disorders such as Attention-

Deficit/Hyperactivity Disorder (ADHD) and learning disorders, which are highly prevalent among children, can lead to difficulties in sustained attention, working memory, planning, organization, and emotional regulation. These difficulties, in turn, negatively affect academic performance (Kiani et al, 2021). In this regard, research has shown that mindfulness-based interventions and cognitive therapies can improve these functions and enhance the cognitive performance of children with learning disorders and ADHD. Numerous studies have emphasized that mindfulness, as a non-pharmacological intervention, can reduce problems such as inattention, anxiety, and poor impulse control by strengthening attention and emotional self-regulation. For example, Segal et al (2012) demonstrated that mindfulness techniques help children better identify and regulate their emotions, particularly in challenging situations requiring concentration and decision-making. Furthermore, combining this approach with other cognitive training programs may lead to improvements in sustained attention, working memory, and cognitive flexibility (Huguet et al, 2017). Findings from various studies have also indicated that mindfulness-based programs significantly improve emotional regulation and reduce anxiety in children with generalized anxiety disorder and ADHD (Hematian et al, 2020). Moreover, incorporating mindfulness techniques into educational programs can strengthen the cognitive abilities of children with specific learning disorders and contribute to improvements in executive functions such as planning, organization, and cognitive flexibility (Dehghani et al, 2021).

Accordingly, the primary aim of the present study was to investigate the effectiveness of a mindfulness-based educational program in improving executive functions and sustained attention among children with learning disorders. Conducting this study may contribute to the identification and enhancement of these children's cognitive and behavioral skills, and its findings may be utilized in developing effective educational and therapeutic strategies aimed at improving executive functioning and enhancing their academic abilities.

Method

Research Design and Participants

The present study employed a quasi-experimental pretest–posttest design with a control group. The statistical population consisted of all children with learning disorders who were referred to the clinic of the Faculty of Psychology and Educational Sciences at the University of Tehran during the 2024–2025 academic year and had received services for learning disorders at this center. From among these children, 30 participants were selected using purposive sampling and were randomly assigned to either the experimental group ($n = 15$) or the control group ($n = 15$). The inclusion criteria consisted of children aged 9 to 12 years diagnosed with learning disorders by the psychologists of the learning disorders clinic, with the diagnosis documented in their clinical records. The exclusion criteria included unwillingness to continue participation in the sessions and absence from more than two treatment sessions.

The research procedure was conducted as follows: after obtaining the necessary coordination with the clinic director, children and their parents were invited to participate in the study. An introductory session was held for the mothers in which the objectives and procedures of the intervention sessions were explained. After informing the participants about the aims of the study, parents were asked to allow their children to participate in the treatment program. Written informed consent was obtained from all parents prior to participation. In addition, educational guidance was also provided to the parents.

Before the initiation of the intervention, both groups were assessed at the pretest stage. Parents were asked to complete the Executive Functions Questionnaire regarding their children, and the IVA test was administered to the children as well. Subsequently, participants were randomly assigned to the two groups, and the experimental group received the mindfulness intervention. The intervention program consisted of twelve 90-minute sessions conducted in a group format

once per week. Following completion of the intervention period, both the experimental and control groups were reassessed during the posttest phase, and the collected data were then analyzed.

Measurement Tools

Integrated Visual and Auditory Continuous Performance Test (IVA)

The Integrated Visual and Auditory Continuous Performance Test (IVA) is a visual–auditory continuous performance test designed to assess two major components, namely attention and response inhibition. This instrument evaluates four primary domains, including attention, vigilance, focus, and processing speed, across different types of attention such as sustained, selective, divided, and persistent attention (response inhibition) (Moreno-García et al, 2015). Previous studies have indicated that the IVA test demonstrates adequate sensitivity (92%) and predictive accuracy (89%) for the accurate assessment of sustained attention in children and adolescents (Boojari et al., 2015). Furthermore, this instrument has shown appropriate sensitivity (92%) and predictive validity (90%) in assessing attention, concentration, and the diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) (Moreno-García et al, 2015). In the present study, the sustained attention component of the IVA test was utilized.

Executive Skills Questionnaire–Revised (ESQ-R)

The original version of the Executive Skills Questionnaire–Revised (ESQ-R) was developed by Dawson and Guare (2018) as a self-report, paper-and-pencil instrument. The questionnaire initially consisted of 33 items. Following psychometric evaluations, Strait et al (2020) revised the instrument and reduced it to 25 items by removing several statements. The revised version assesses five executive skill domains, including planning, time management, emotional regulation, organization, and behavioral regulation. The questionnaire is scored using a Likert scale ranging from “Never” to “Always,” with scores from 0 to 3 assigned respectively. The questionnaire has demonstrated satisfactory validity and reliability. For example, Strait et al (2020) reported a Cronbach’s alpha coefficient of .91 for the total scale, and Nasir and Pheh (2021) confirmed the construct validity of the instrument. In addition, Abdolmohamadi and Alimohamadi (2025) reported the following internal consistency coefficients: .91 for the total executive skills score, .86 for planning, .62 for time management, .68 for emotional regulation, .72 for organization, and .79 for behavioral regulation. In the present study, the calculated internal consistency coefficients were .91 for the total executive skills score, .86 for planning, .62 for time management, .68 for emotional regulation, .72 for organization, and .79 for behavioral regulation.

Intervention Protocol

The content of the Mindfulness-Based Cognitive Therapy (MBCT) sessions was designed and implemented based on the adapted protocol of Semple and Lee (2011). A summary of the session structure and content is presented in Table 1.

Table 1. Content of Mindfulness-Based Cognitive Therapy (MBCT) Protocol Sessions

Sessions	Goal	Activity	Implementation Method
1	Establishing communication, creating a friendly atmosphere, and providing initial explanations about the intervention program	Establishing rapport and familiarity with the therapeutic environment, participants, and rules; introducing the concept of mindfulness	In this session, the therapist and participants become acquainted with each other, and participants’ initial questions are answered.
2	Understanding attention distractors, the wandering mind, and awareness of bodily sensations	Discussing obstacles to mindfulness, emphasizing practice as the foundation of the work, moving slowly but mindfully, and mindful breathing training	In this session, the therapist attempts to familiarize participants with bodily sensations through exercises such as deep breathing and attention to breathing.

Sessions	Goal	Activity	Implementation Method
3	Growth development and of mindful thoughts	Mindful attention to thoughts and bodily sensations, mindful attention to the body, and three mindful breaths	In this session, the therapist attempts to develop mindful attention through exercises such as mindful sitting and practicing three mindful breaths.
4	Remaining in the present moment and mindful living	Reviewing exercises from previous sessions, performing mindful yoga movements, and practicing a three-minute mindful breathing exercise	In this session, the therapist introduces the three-minute mindful breathing exercise and maintaining attention.
5	Becoming familiar with thoughts, accepting them, and understanding their relationship with bodily sensations	Mindful listening, mindful attention to the body, practicing a three-minute mindful breathing exercise, and thought clouds exercise	In this session, the therapist encourages participants to observe thoughts without judgment and describe their bodily sensations.
6	Becoming aware of emotions and observing them without assigning meaning to them	Mindful attention to emotions and bodily symptoms created by emotions, and muscle relaxation	In this session, the therapist conducts three-minute mindful breathing exercises, mindful yoga movements, another three-minute breathing exercise, and emotion identification exercises.
7	Strengthening bodily mindfulness	Conducting a three-minute mindful breathing exercise and reviewing all exercises	In this session, the therapist strengthens mindfulness through mindful yoga movements, a three-minute mindful breathing exercise, and mindfulness-based body exercises.
8	Awareness of thoughts, bodily sensations, and emotions, and redirecting attention to stimuli	Clear visualization, mindful yoga movements, observing thoughts and mental events and allowing them to pass, and practicing a three-minute mindful breathing exercise	In this session, the therapist uses various activities to help participants become aware of their bodily sensations, emotions, and thoughts.
9	Learning body scanning and focusing on different parts of the body	Performing mindful movements and mindful walking, and focusing on one's body	In this session, the therapist conducts body scan activities, such as imagining light moving from the head down through the body.
10	Integration of bodily sensations, mood, and emotions	Conducting a three-minute mindful breathing exercise, mindful touch, mindful attention to the body, and another three-minute mindful breathing exercise	In this session, the therapist helps participants integrate emotions, bodily sensations, and mood through various activities.
11	Mindful living and attention management	Mindful smelling and mindful yoga movements	In this session, the therapist helps participants develop attention management and mindful living through various activities.
12	Review of sessions and continuation and maintenance of mindfulness	Generalizing the learned concepts to all life activities such as classroom activities, home environment, and shopping	In this session, the therapist reviews previous activities conducted throughout the treatment and attempts to help participants generalize mindfulness to all aspects of life.

Procedure

For data analysis, both descriptive and inferential statistics were used. At the descriptive level, frequency, percentage, mean, and standard deviation were employed, while at the inferential level, multivariate analysis of covariance (MANCOVA) was conducted using IBM SPSS Statistics version 25.

Results

In Table 2, the mean and standard deviation of the participants in the experimental and control groups are reported.

Table 2. Mean Scores and Standard Deviations of Executive Function and Sustained Attention Components

Variable	Stage	Group	Mean	Standard Deviation
Planning	Pretest	Experimental Group	23/85	2/60
		Control Group	24/88	3/14
	Posttest	Experimental Group	18/72	2/15
		Control Group	18/72	2/15
Emotion Regulation	Pretest	Experimental Group	7/00	1/65
		Control Group	7/33	1/18
	Posttest	Experimental Group	4/38	2/64
		Control Group	7/41	1/55
Time Management	Pretest	Experimental Group	9/14	1/70
		Control Group	9/26	1/49
	Posttest	Experimental Group	6/60	2/17
		Control Group	9/53	1/23
Organization	Pretest	Experimental Group	7/34	0/97
		Control Group	6/80	0/11
	Posttest	Experimental Group	5/33	1/11
		Control Group	5/61	1/92
Behavior Regulation	Pretest	Experimental Group	7/92	1/94
		Control Group	7/53	1/45
	Posttest	Experimental Group	7/13	1/91
		Control Group	6/80	0/87
Visual Sustained Attention	Pretest	Experimental Group	71/45	4/39
		Control Group	71/06	5/59
	Posttest	Experimental Group	72/54	6/04
		Control Group	73/87	5/28
Auditory Sustained Attention	Pretest	Experimental Group	67/45	8/29
		Control Group	72/80	8/60
	Posttest	Experimental Group	65/82	7/38
		Control Group	72/52	8/87

Given that the aim of the present study was to investigate the effect of Mindfulness-Based Cognitive Therapy (MBCT) on improving executive functions and sustained attention in children with learning disabilities, the assumptions of multivariate analysis of covariance (MANCOVA) were first examined before testing the hypothesis. To assess the equality of variances, Levene's test was conducted.

Table 3. Levene's Test for Examining the Homogeneity of Variances

Variable	F	df1	df2	Sig
Planning	0/169	1	28	0/68
Emotion Regulation	0/198	1	28	0/66
Time Management	3/11	1	28	0/08
Organization	2/59	1	28	0/11
Behavior Regulation	0/66	1	28	0/42
Visual Sustained Attention	2/51	1	28	0/12
Auditory Sustained Attention	1/61	1	28	0/31

According to the results presented in Table 3, Levene's test was not statistically significant, indicating that the assumption of homogeneity of variances was satisfied and that conducting the analysis of covariance was appropriate. In addition, examination of the homogeneity of covariance matrices using Box's test (Box's $M = 18.74$) indicated that this assumption was also met ($P > 0.05$). Furthermore, the interaction between the covariate (pretest scores) and the group was not significant, indicating that the assumption of homogeneity of regression slopes was satisfied. Therefore, conducting multivariate analysis of covariance was permissible. Since the assumptions of parametric testing were met, analysis of covariance was used for data analysis. The results of the covariance analysis demonstrated that the changes observed between the two groups at the post-intervention stage were statistically significant. In addition, to compare the two groups on each dependent variable separately, tests of between-subjects effects within the univariate analysis of covariance were conducted, the results of which are presented in Table 4.

Table 4. Multivariate Analysis of Covariance (MANCOVA) for Examining the Effectiveness of Mindfulness-Based Cognitive Therapy (MBCT)

Variable	SS	DF	F	Sig
Planning	237/85	1	44/75	0/0001
Emotion Regulation	18/21	1	9/07	0/006
Time Management	41/42	1	14/12	0/001
Organization	3/25	1	1/52	0/22
Behavior Regulation	0/036	1	0/16	0/89
Visual Sustained Attention	46/86	1	2/55	0/12
Auditory Sustained Attention	54/83	1	1/78	0/19

The results of the multivariate analysis of covariance presented in Table 4 showed that, after controlling for pretest scores, the effect of group on posttest scores was significant for the planning component ($F(1,29) = 44.75$, $P = 0.001$), the emotion regulation component ($F(1,29) = 9.07$, $P = 0.006$), and the time management component ($F(1,29) = 14.12$, $P = 0.001$). Specifically, following the MBCT intervention, scores on planning, emotion regulation, and time management significantly increased in the experimental group compared to the control group. In contrast, after controlling for pretest scores, the effect of group on posttest scores was not significant for the organization component ($F(1,29) = 1.52$, $P = 0.22$) or the behavior regulation component ($F(1,29) = 0.16$, $P = 0.89$). These findings indicate that the MBCT intervention did not lead to significant improvements in organization or behavior regulation compared with the control group. Furthermore, the findings showed that the Mindfulness-Based Cognitive Therapy intervention did not have a significant effect on sustained attention.

Discussion and Conclusion

The present study was conducted to investigate the effectiveness of Mindfulness-Based Cognitive Therapy (MBCT) training on improving executive functions in children with learning disorders. The findings indicated that these interventions significantly improved various components of executive functioning, including planning, emotional regulation, and time management, in the experimental group. These findings are consistent with previous studies (Sattari Shiraz and Sattari Shiraz, 2024; Dehghani et al, 2021). The results further confirm that mindfulness training can serve as a valid and reliable intervention for enhancing executive functions in children with learning disorders.

One of the important components examined in the present study was the effect of mindfulness training on emotional regulation. In particular, children with learning disorders often experience difficulties in regulating their emotions in challenging situations such as examinations or social interactions. However, in the current study, children in the experimental group demonstrated a greater ability to manage their emotions effectively in stressful situations after participating in mindfulness-based training sessions.

The findings may be explained by the fact that Mindfulness-Based Cognitive Therapy (MBCT), through strengthening present-moment awareness and nonjudgmental acceptance of thoughts and feelings, helps children not only overcome emotional difficulties but also enhance their cognitive abilities. More specifically, these interventions enable children to confront their experiences and emotions without negatively evaluating themselves or their circumstances, thereby improving their functioning across different life situations. These effects were particularly evident in enhanced emotional regulation and planning ability. In fact, mindfulness, by increasing self-awareness and emotional control, helps individuals regulate their plans more effectively and improve their decision-making abilities (Hematian et al., 2020).

These findings are consistent with the results reported by Mohammadzadeghan et al. (2022), who demonstrated that mindfulness can reduce anxiety and improve emotional regulation. Previous studies have also shown that self-awareness, particularly among children with learning disorders, can significantly improve executive functions such as time management, planning,

and reduced impulsivity. Similar findings have been confirmed in several other studies as well (Mohammadzadeghan et al., 2022). The findings of the present study are in line with these results. Therefore, it can be concluded that the self-awareness fostered through mindfulness plays a fundamental role in strengthening the cognitive capacities necessary for the academic functioning of children with learning disorders.

Another important effect of mindfulness training involves its impact on the prefrontal cortex, which is the primary brain region responsible for executive functions such as planning, attentional control, and emotional regulation. Through mindfulness practices that emphasize self-awareness and nonjudgmental control, this brain region becomes more active. This process helps children apply their cognitive abilities in a more organized and effective manner (Dehghani et al, 2021). Accordingly, mindfulness processes may enhance individuals' capacity to regulate behaviors and make decisions associated with executive functioning (Malekzadeh et al., 2023).

The findings of the present study also indicated that children in the experimental group demonstrated greater sustained attention and showed better performance in time management and task completion. This finding is consistent with the results reported by Sattari Shiraz and Sattari Shiraz (2024). These results emphasize that mindfulness plays a fundamental role not only in emotional regulation but also in improving attentional and task-oriented skills.

Overall, it can be concluded that Mindfulness-Based Cognitive Therapy (MBCT) training improves executive functioning in children with learning disorders. In order to successfully master academic tasks, students must acquire a range of essential skills that develop through experience, education, and learning. While most children perform these skills automatically, children with learning disorders often experience difficulties in applying such skills during learning processes and therefore require explicit instruction and support. These interventions, by strengthening abilities such as sustained attention, planning, emotional regulation, and working memory, can substantially improve the academic performance of these children.

Finally, it should be noted that the present study had several limitations, including the limited sample size, non-random participant selection, and the inability to control for participants' economic, social, and educational conditions, all of which may restrict the generalizability of the findings. Therefore, future studies are recommended to be conducted across different regions and with more diverse populations. In addition, considering the effectiveness of this intervention, examining its applicability in other groups, such as children with neurodevelopmental disorders, is also recommended. Despite these limitations, the findings of the present study highlight the importance of incorporating mindfulness-based approaches into educational and therapeutic settings and introduce mindfulness as an effective method for improving the cognitive and emotional functioning of children with learning disorders.

Declarations

Author Contributions

All authors equally contributed to the conception, design, data collection, analysis, and writing of this research.

Data Availability Statement

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

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Ethical considerations

Informed consent to use written and verbal data for research purposes was obtained from all participants prior to the simulation. It was clearly stated that verbal data will be recorded and/or analyzed for academic research purposes, and participants were given the option to refuse their data to be recorded at any time prior, during or after the event.

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Conflict of interest

The authors declare that there were no conflicts of interest in conducting this research.

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