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Effectiveness of the Easy Minds Educational Program on Executive Functions and Mathematics Self-Efficacy in Students with Mathematics Disorder

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ABSTRACT

Objective: This study aimed to examine the effectiveness of the Easy Minds educational program on executive functions and mathematics self-efficacy among students with mathematics disorder.

Methods and Materials: A quasi-experimental pretest–posttest control-group design with a two-month follow-up was conducted. The study population comprised students with mathematics disorder who were referred to the Learning Disorders Center of Bushehr Province during the 2023–2024 academic year. Forty-five eligible students were selected through purposive sampling and randomly assigned to experimental and control groups, with 15 students in each group. Data were collected using the N-back Working Memory Test, Stroop Color-Word Test, Wisconsin Card Sorting Test, and Mathematics Self-Efficacy Questionnaire. The experimental group received the Easy Minds educational program over 14 45-minute sessions, while the control group received no intervention. Data were analyzed using repeated-measures ANOVA and post hoc tests.

Findings: Significant group × time effects were observed for working memory, $F = 35.671$, $p < .01$, $\eta^2 = .43$; selective attention, $F = 38.842$, $p < .01$, $\eta^2 = .51$; cognitive flexibility, $F = 39.029$, $p < .01$, $\eta^2 = .43$; and mathematics self-efficacy, $F = 37.624$, $p < .01$, $\eta^2 = .51$. Improvements in all variables remained stable at the two-month follow-up, whereas no comparable improvement was observed in the control group.

Conclusion: The Easy Minds educational program effectively improves executive functions and mathematics self-efficacy in students with mathematics disorder and may be considered a useful educational intervention in learning disorder settings.

Keywords: Easy Minds Program, Mathematics Disorder, Executive Functions, Mathematics Self-Efficacy, Learning Disabilities.

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Introduction

Learning is the most fundamental process by which an incapable and helpless organism, over time and through interaction with the physical and psychological environment, becomes a developed individual whose cognitive abilities know no limits (Wang et al., 2013). Although learning once created differences among individuals, today we observe that, despite many similarities among humans, they learn and are educated differently. Therefore, when learning materials become broader and more extensive, learning problems emerge among individuals (Nurmahanani, 2025). Unfortunately, every year, many children experience pervasive and serious difficulties at school and in academic learning due to their inability to learn educational and school-related content, and they are forced to accept and continue under these conditions (Malekpour & Aghababaei, 2013). Learning disability affects these students' functioning in all areas of life, including psychological, behavioral, and interpersonal domains. For children with learning disabilities, keeping pace with peers in some subjects is often difficult, even as they may show excellent performance in others. Therefore, since the mid-twentieth century, a new group of students has been identified who do not fit into either the normal or exceptional categories (de Santana et al., 2025).

In its latest classification, the American Psychiatric Association has classified learning disabilities under the title of specific disorders in the form of disorders in academic skills, including reading, writing, and mathematics; language and speech disorders; and motor skills disorders (Brennan, 2021). The term learning disability is used to describe a presumed neurological disorder that affects the brain's ability to receive, process, store, react to, and respond to information (Moradi, 2024). This term refers to a disorder in one or more basic psychological processes involved in understanding or using spoken and written language, which may appear as deficits in the ability to listen, think, speak, read, write, or perform mathematical calculations (JALIL et al., 2013).

One of the areas that creates problems for students with learning disorders is the learning of mathematical skills. Hanschen considered impairment in mathematical performance to be caused by dysfunction in the central nervous system and in the external autonomic neural network related to mathematical ability (Ghobari–Bonab et al., 2013). In the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* of the American Psychiatric Association (2013), mathematical disability is classified under the category of specific neurodevelopmental learning disorder. Disorder in mathematics, or in other words dyscalculia, which causes difficulty for many students, means that a person's mathematical ability, considering chronological age, measured intelligence, and age-appropriate education, is significantly lower than expected, and these difficulties are not caused by intellectual, neurological, sensory, visual or auditory, or motor disorders.

Researchers believe that many students with mathematics learning disorder face fundamental problems in learning mathematics, which often appear during elementary school and continue into middle school and high school (Gersten et al., 2005). Mathematical disability affects academic achievement and daily life activities that require mathematical skills. If a sensory deficit exists, problems in mathematical ability are usually added to the problems associated with that deficit. More clearly, in mathematical disability, deficits have been identified in four groups of skills: first, linguistic skills, which are related to understanding mathematical terms and converting written problems into mathematical symbols; second, perceptual skills, including the ability to recognize and understand symbols, arrange sets, and correctly perceive operational concepts (Kaplan & Sadock, 1988); third, mathematical skills, including addition, subtraction, multiplication, division, exponentiation, and abilities related to the four basic operations; and fourth, attentional skills, including accurately copying shapes and correctly observing operational symbols (Di Giusto et al., 2023). In fact, the main problems for children with mathematical disabilities often involve mathematical calculation or reasoning. These problems may appear in different forms. It is known that these deficits are related to neuropsychological development and functioning, all indicating that the mental processes of mathematical reasoning and calculation have not developed properly and have been impaired to varying degrees.

Various studies have examined the factors that influence the emergence and development of mathematical disability. For example, in Iran, Aghaei et al. (2025); Habibi Khouzani et al. (2023); Karbasdehi et al.

(2019); Mahmoodi & Akbari (2025), and Soleymani Khashab et al. (2021) showed in their studies that self-esteem and mathematical performance of students with mathematical disabilities improve through executive function training. In other countries, researchers such as Clements et al. (2020), Espinoza-Ortiz & Guerrero-Jiménez (2026), Mulcahy et al. (2021), and many others have shown in their studies that mathematics instruction that strengthens executive functions yields dual benefits, improving performance in both mathematics and executive functions. Therefore, movement-based training can be highly effective and practical for children with learning disabilities in mathematics. Accordingly, based on the above, it can be stated that most studies consider weakness in executive functions to be the main cause of difficulties in mathematics (Kryvand & Vaziri Goodarzi, 2016) and have shown that students with learning disabilities have poorer executive functioning, including attention, concentration, memory, cognitive flexibility, and planning, compared with their peers. Executive functions are among the abilities children need for learning school subjects (Khalife et al., 2014). These functions include better performance in various areas such as inhibition and stimulus control, cognitive flexibility, planning, organization, and related abilities. Working memory is defined as the mental workspace that includes controlling, regulating, and actively processing information to reach an answer in complex cognitive tasks such as mathematical problem solving (A MohammadiMalekabadi et al., 2017). However, these children often exhibit deficits in visual perception and selective attention. ROSS (1982) believed that there is a mental deficit faced by most children with learning disabilities, namely the inability to concentrate attention on the subject under discussion. He used the concept of selective attention and stated that learning disabilities are rooted in a developmental delay in the ability to sustain it. Selective attention, or the ability to focus on specific stimuli while ignoring distracting ones, allows us to attend to and respond only to those aspects of our environment that are relevant to our goals. Therefore, this type of attention involves freeing oneself from distraction (NOUREH et al., 2014). Thus, it can be stated that working memory and attention are the foundations of learning and thinking and play an important role in learning mathematics; they are also considered important components in learning disabilities (A MohammadiMalekabadi et al., 2017). On the other hand, most authors have reported in their studies that mathematical skills are closely related to students' cognitive flexibility, and that multiple weaknesses in executive functioning are often observed in children with mathematical difficulties.

Given the aforementioned factors, the characteristics of students with mathematical disabilities, and the importance of mathematics, the use of appropriate educational approaches is essential. Although learning disorders have a strong biological basis, interventions for learning problems primarily rely on educational and psychosocial approaches rather than biological treatments (Lezak, 2004). Recently, researchers have shown that incorporating physical activity into mathematics-related academic tasks improves academic performance, academic self-regulation, academic self-efficacy, and executive functions (Nurmahanani, 2025). One of the new psychological interventions derived from physical activities and cognitive activities related to mathematics is the Easy Minds program. This program was first implemented in 2014 by Riley et al. (2014) and colleagues in elementary schools in New Zealand. The program, titled "Encouraging Activity to Stimulate Young Minds," or Easy Minds, was designed to increase children's levels of physical activity through movement-based mathematics learning experiences in elementary schools. The Easy Minds training program is a type of mathematics instruction that integrates physical movement, increasing students' engagement and involvement in mathematics, enhancing their enjoyment of the subject, and improving the quality of teaching for teachers (Riley et al., 2014). In this program, two types of activities are considered for instruction: first, activities that use movement as a framework to improve the fluent learning of basic number calculations; and second, instruction that views mathematics within the school environment. In addition, according to students' reports, this program improves the quality of active methods for teaching mathematics and enhances students' memory and attentional performance (Kryvand & Vaziri Goodarzi, 2016). The multisensory nature of the Easy Minds program, through the use of different senses during instruction and problem solving by children, gives mathematics a more realistic aspect. According to Riley et al. (2014), this type of instruction was especially beneficial for students with persistent difficulties learning mathematics.

Overall, considering the long-term consequences of learning disorders, or mathematical deficiencies, and the fundamental role of mathematics learning in modern life, as well as the high prevalence of these disorders among students in our country, it is important to plan to address their learning problems. Therefore, examining the effectiveness of the Easy Minds educational method in these students is one of the research gaps, and using the results of the present study in the field of prevention and empowerment of students with learning disorders is among the important necessities of this study. Accordingly, based on the aforementioned points, the present study aimed to examine the effectiveness of the Easy Minds educational method on executive functions and mathematical self-efficacy among students with mathematics disorder.

Methods and Materials

Study Design

The present study was quasi-experimental, using a pretest–posttest control group design with a two-month follow-up period.

Population, Sample, and Sampling Method

The statistical population of this study included all fourth-, fifth-, and sixth-grade elementary school students who had been referred to the Learning Disorders Center of Bushehr Province since October 2023 and had been diagnosed with a mathematical disability. The research population consisted of 127 students. From this population, 45 students were selected through purposive sampling after being diagnosed with a mathematics learning disorder using diagnostic tests and the criteria in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*. They were then randomly assigned to one experimental group and one control group, with 15 students in each group. The inclusion criteria included consent to participate in the study, normal intelligence quotient (95–105), age range of 8 to 13 years, enrollment in fourth, fifth, or sixth grade, Persian as the native language, not receiving any simultaneous pharmacological or psychological treatment, and absence of any physical or psychological illness that could interfere with the research variables. To examine various physical and psychological aspects of the students, psychometric colleagues at the center conducted a clinical interview and several tests upon each student's entry.

The following instruments were used to collect data:

N-Back Working Memory Software

In this study, working memory is defined as the individual's score on the N-back working memory test. This test was first introduced by Kirchner (1958). In this task, a sequence of stimuli, generally visual, is presented step by step to the participant, and the participant must determine whether the currently presented stimulus matches the stimulus presented N steps earlier. The test is performed with different values of N, and as N increases, the task becomes more difficult. This test is one of the most widely used culture-free instruments. In this test, several visual stimuli appear sequentially on the screen, and the participant must press the “?” key if each stimulus is similar to the previous one and the “Z” key if it is not. In this task, the individual must keep the information of only one stimulus in memory, namely the stimulus presented one step earlier. In addition, as a new stimulus replaces the previous one, updating according to the rules of working memory is necessary. The task is designed so that individuals must respond to all stimuli at every stage. Therefore, this task requires continuous monitoring and updating of information in working memory. In this test, a set of 100 line drawings is used. This test has strong validity and is currently widely used in clinical and experimental studies. Several other working memory tests have demonstrated its validity. Busch (2013) reported the reliability of this test as 78%. In Iran, Taghizadeh et al. (2014) used this test in their studies and confirmed its reliability.

Stroop Color-Word Test

This test was developed by Stroop (1935) to assess selective attention and cognitive flexibility. Since then, different versions of this test have been developed, including the Golden (1975) and Graf et al. (1995) versions. The number of cards used in each test varies, and various forms of the Stroop task have been developed for research purposes, including simple, complex, semantic, and modified Stroop tasks (Bonyadi et al., 2020). The test used in the present study is a common neuropsychological assessment of executive functions. In addition, the Stroop test also refers to the basic attention system. The standard color-word Stroop test, sometimes called the serial color-word test, follows the same procedure originally used by Stroop (1935). In this study, the computerized version of the Stroop test was used. In this test, 48 congruent color words, in which the color of the word matches its meaning, including red, yellow, green, and blue, and 48 incongruent color words, in which the color of the word does not match its meaning, for example, the word "blue" shown in red, are presented with a stimulus interval of 800 milliseconds and a stimulus presentation duration of 200 milliseconds. The participant's task is to select only the correct color. For scoring and interpreting the results of this test, scores are calculated separately for congruent and incongruent word groups, including the number of errors, the number of correct responses, reaction time, and the interference score. The interference score is calculated by determining the difference between the reaction time to incongruent words and the reaction time to congruent words. It should be noted that the validity and reliability of this test, as reported in retesting, have ranged from 80% to 91% (Kargarshourki et al., 2010).

Wisconsin Card Sorting Test

The original version of the Wisconsin Card Sorting Test was developed by Berg et al. (2015). The Wisconsin Card Sorting Test is one of the most widely used neuropsychological instruments for assessing concept formation, abstract thinking, cognitive flexibility, and the ability to shift cognitive sets. This test is used to examine set shifting, flexibility, problem solving, concept formation, and the ability to overcome perseverative tendencies, which are considered executive functions of the brain. The test assesses four subscales: categories achieved, perseverative errors, other errors, and total errors. In this test, the participant is presented with a set of 64 cards twice, each containing one to four symbols or shapes, including triangles, stars, crosses, and circles, in red, green, yellow, and blue. No two cards are identical. Four cards, including one red triangle, two green stars, three yellow crosses, and four blue circles, are used as the main cards. The participant's task is to place the remaining cards under the four main cards according to the rule governing them. After each response, the participant receives feedback indicating whether the response is correct or incorrect. In other words, the participant is told whether the placement was right or wrong. The intended pattern for the four main cards is color, shape, and number, respectively, and this pattern is repeated. After the participant provides a sufficient number of consecutive correct responses, the intended pattern changes; however, the participant is not informed of the change and must discover it independently. The two main performance indices are the number of categories achieved and the number of perseverative errors (Zeini et al., 2016). Various studies have supported the validity and reliability of the Wisconsin Card Sorting Test.

Mathematics Self-Efficacy Questionnaire

Pouraghdam and Behrangi (2009) designed the Mathematics Self-Efficacy Questionnaire, consisting of 13 items, based on Bandura's (1986) teachings regarding the similarity between self-efficacy questionnaires and performance assessment domains. To respond to this questionnaire, the participant indicates their perceived ability for each mathematics exam question on an 11-point scale from 0 to 10. Each item is scored from 0 to 10 (Bonyadi et al., 2020). Its construct validity has been confirmed, and the reliability of this questionnaire has been reported as 0.91.

Easy Minds Educational Program

The Easy Minds educational program was developed by Riley et al. (2014). Accordingly, some exercises were removed from the educational program because they were not aligned with the mathematics lessons for fourth-, fifth-, and sixth-grade students in Iranian schools. Other exercises were designed based on the content of mathematics textbooks for grades four to six and on the researcher's creativity. The educational program was implemented in 14 45-minute sessions over five weeks. A description of the sessions is presented in Table 1.

Table 1

Summary of the Easy Minds Educational Program

Session	Session content
Session 1	Obtaining permission from students' parents, familiarizing them with the researcher, and explaining the Easy Minds program
Session 2	Administering the pretests and questionnaires
Session 3	Beginning movement-based instruction: number writing and numerical patterns using physical activities
Session 4	Teaching place value of numbers using colored baskets and individual and group physical movements
Session 5	Drawing a chalk number line in the yard to teach addition and subtraction of multi-digit numbers
Session 6	Teaching addition and subtraction of compound numbers by drawing a chalk clock in the yard based on sports and physical activity
Session 7	Making a wall clock with cardboard and teaching the concept of time by moving the hands; reviewing addition and subtraction of compound numbers by moving the clock hands.
Session 8	Teaching multiplication of two-digit numbers through tapping on the table and clapping
Session 9	Calculating the perimeter of different shapes drawn in the yard using a meter, hand span, or steps by students
Session 10	Drawing cardboard square patterns and calculating their perimeters using the method of the previous session
Session 11	Beginning instruction on the concept of fractions using chalk stairs drawn in the yard
Session 12	Teaching the conversion of mixed numbers to fractions and vice versa using chalk stairs drawn in the yard
Session 13	Teaching the concept of ratio and proportion using chalk stairs drawn in the yard and placing colored cardboard pieces on part of them
Session 14	Teaching the concept of symmetry using tree leaves, cardboard, and other available natural materials
Session 15	Summarizing, concluding, and administering the posttest

Procedure

After consulting the Department of Special Education of Bushehr Province and obtaining permission to enter the Learning Disorders School during the 2023–2024 academic year, the researcher officially began the study using purposive sampling and in accordance with the inclusion and exclusion criteria. The sampling method was purposive. After receiving the ethics code IR.BPUMS.REC.1403.158, approved by the Ethics Committee in Medical Sciences Research of Bushehr on August 12, 2024, and after the necessary coordination, the sample group was identified and randomly assigned to two groups. The pretest was then administered separately to the experimental and control groups. Next, plans were made to deliver the Easy Minds training program to the experimental group on even-numbered days. After final coordination with the parents and the Learning Disorders Center, the experimental group received the specified treatment at the Center. In contrast, the control group received no treatment until the end of data collection at the follow-up stage. To reduce the transfer effect, all participants were asked to complete a form indicating that they would not receive any other training and would not transfer the content they received to others. In this way, the probability of the transfer effect was minimized. At the end of the treatment period, the posttest was administered separately to both groups, and two months later, the follow-up stage was also conducted. The collected data were then analyzed using SPSS version 26.

Findings and Results

The mean and standard deviation were calculated for the experimental and control groups, each consisting of eight girls and seven boys. The educational level of the participants' fathers and mothers in the experimental group was as follows: 33.33% below a diploma, 40% a bachelor's degree, and 26.66% a master's degree. In the control group, 13.33% had less than a diploma, 20% had a diploma, 50.33% had a bachelor's degree, and 6.66% had a master's degree. Table 2 shows the mean and standard deviation of students' executive functions, including working memory, selective attention, and cognitive flexibility, as well as mathematics self-efficacy in the Easy Minds training group and the control group based on pretest, posttest, and follow-up scores.

Table 2

Mean and Standard Deviation of research variables

Variables	Group	Pretest	Posttest	Follow-up
Working memory	Experimental	22.27 ± 11.8	52.07 ± 11.18	24.01 ± 12.18
	Control	19.37 ± 11.7	21.08 ± 11.7	28.46 ± 11.7
Selective attention	Experimental	14.42 ± 11.7	92.46 ± 11.18	65.02 ± 11.18
	Control	63.08 ± 12.7	27.17 ± 11.6	38.32 ± 11.6
Cognitive flexibility	Experimental	35.24 ± 10.4	57.28 ± 19.9	68.31 ± 19.9
	Control	19.18 ± 10.4	06.09 ± 10.4	07.15 ± 10.4
Mathematics self-efficacy	Experimental	73.1 ± 9.8	39.64 ± 12.21	27.53 ± 12.21
	Control	69.1 ± 9.8	27.45 ± 9.8	21.37 ± 9.8

Based on Table 2, the means and standard deviations of the research variables, including working memory, selective attention, cognitive flexibility, and mathematics self-efficacy, improved in the Easy Minds training group from pretest to posttest and follow-up. However, in the control group, no change was observed in these variables across the pretest, posttest, and follow-up stages. Before data analysis, the assumptions of repeated-measures analysis of variance, including Box's test, Mauchly's test of sphericity, and Levene's test, were examined for the groups. The results showed that the assumption of homogeneity of variance-covariance matrices was properly met.

Table 3

Results of Repeated-Measures Analysis of Variance for Comparing Pretest, Posttest, and Follow-up Scores of Working Memory

Variable	Source	SS	df	MS	F	Effect size
Working memory	Time	84.234	1	84.234	75.312**	0.43
	Error	65.216	44	1.482		
	Group	245.064	2	122.532	9.218**	
	Error	481.267	44	10.937		
	Group × Time	68.509	2	34.254	35.671**	

Note. p < 0.01

Table 3 shows significant differences among the pretest, posttest, and follow-up working memory means for the two groups. In addition, the table shows that the effect size of Easy Minds training on working memory was 0.43.

Table 4

Results of Repeated-Measures Analysis of Variance for Comparing Pretest, Posttest, and Follow-up Scores of Selective Attention

Variable	Source	SS	df	MS	F	Effect size
Selective attention	Time	75.318	1	75.318	81.284**	0.51
	Error	58.614	44	1.332		
	Group	287.167	2	143.583	12.516**	
	Error	381.561	44	8.671		
	Group × Time	73.527	2	36.763	38.842**	

Note. p < 0.01

Table 4 shows a significant difference among the pretest, posttest, and follow-up means of selective attention between the two groups. In addition, the table shows that the effect size of Easy Minds training on selective attention was 0.51.

Table 5

Results of Repeated-Measures Analysis of Variance for Comparing Pretest, Posttest, and Follow-up Scores of Cognitive Flexibility

Variable	Source	SS	df	MS	F	Effect size
Cognitive flexibility	Time	81.286	1	81.286	76.164**	0.43
	Error	69.308	44	1.575		
	Group	357.206	2	178.603	11.468**	
	Error	245.046	44	5.578		
	Group × Time	71.652	2	35.826	39.029**	

Note. p < 0.01

Table 5 shows significant differences in the pretest, posttest, and follow-up cognitive flexibility means between the two groups. In addition, the table shows that the effect size of Easy Minds training on cognitive flexibility was 0.43.

Table 6

Results of Repeated-Measures Analysis of Variance for Comparing Pretest, Posttest, and Follow-up Scores of Mathematics Self-Efficacy in the Easy Minds Training and Control Groups

Variable	Source	SS	df	MS	F	Effect size
Mathematics self-efficacy	Time	64.381	1	64.381	71.234**	0.51
	Error	61.274	44	1.392		
	Group	298.153	2	149.076	11.468**	
	Error	196.237	44	4.459		
	Group × Time	72.298	2	36.149	37.624**	

Note. $p < 0.01$

Table 6 shows a significant difference among the pretest, posttest, and follow-up means of mathematics self-efficacy between the two groups. In addition, the table shows that the effect size of Easy Minds training on mathematics self-efficacy was 0.51.

Discussion and Conclusion

The present study aimed to examine the effectiveness of the Easy Minds educational method on executive functions and mathematics self-efficacy among students with mathematics disorder. The results of the study indicated that the use of the above educational method led to a significant improvement in executive functions and mathematics self-efficacy among students with mathematics disorder. In addition, it was found that the effect of this training remained stable up to two months after the end of the educational sessions.

In explaining the above findings regarding the effect of the Easy Minds educational method on executive functions, including working memory, attention, and cognitive flexibility, as well as mathematics self-efficacy, it can be stated that the Easy Minds educational method, compared with the control group, was effective on the working memory of children with mathematics learning disorder. These differences remained stable at the follow-up stage. In explaining this issue, movement, as an influential factor in a child's comprehensive development, can be examined from two perspectives. The first is movement in its general sense, which includes the apparently purposeless movements of infancy, children's activity and restlessness, games, and goal-directed movements, all of which make behaviors possible in later stages of development. The second is movement in its more specific, precise sense, which includes characteristics that, when applied, can lead to intended outcomes, such as rhythmic movements (Baddeley, 2020). Working memory is one of the complex systems of executive functions. On the other hand, executive functions are influenced by higher prefrontal cortex functions. Therefore, it can be concluded that damage or dysfunction in subcortical areas of the brain is significantly related to working memory ability. Based on previous studies, cognitive-behavioral interventions can improve children's working memory performance by affecting this system (Foster et al., 2015; Miller et al., 2018; Sharifi & Rezaei, 2018). Various studies have linked cognitive performance and improvements in working memory to exercise and motor activities (Goldshtrom et al., 2011). Current scientific studies show the effects of rhythmic games and exercises and indicate a positive relationship between play and improvements in working memory. Research shows a positive relationship between play and learning. Other studies have also shown that play can improve working memory, planning skills, attitude, creativity and divergent thinking, affect, and language development (Shafiei et al., 2009). It seems that, because of its cognitive nature, working memory is influenced by experience. The Easy Minds program provided an integrated mathematics learning experience, which may affect working memory by influencing the cognitive system.

Based on the theories of selective attention and inhibition, the effect of the Easy Minds educational method on the second component of executive function, namely attention, can be explained. The results of the present study showed that Easy Minds training improves selective attention in children with mathematics disorder. This finding is consistent with the studies of Clark (2023), Dehghani et al. (2024), and Lecce et al. (2026). According to the present study's findings, the Easy Minds-based intervention increased these students' cognitive engagement. It improved their academic performance by inhibiting negative emotions and increasing positive emotions. In explaining this finding, it is also worth noting that an inability to cognitively process emotional information leads to emotional and cognitive confusion and helplessness in the individual. This inability disrupts the organization of emotions and cognitions in these students and, under stressful conditions, leads to failure and consequently academic burnout. As Clark (2023) pointed out, in explaining the effectiveness of Easy Minds in improving selective attention, these students, due to weaknesses in reasoning, often have problems with perception and social interaction with classmates and others (Raeisi et al., 2008). Easy Minds training helps these students monitor their actions and reactions toward others and improve their judgment, planning, and cognitive flexibility in relation to others (Wang et al., 2013). By inhibiting negative feelings toward others and sharing their perceptions with them, these students can establish desirable and effective relationships and, in response to positive feedback, strengthen their self-esteem, ultimately leading to increased inhibition and improved selective attention. Therefore, it can be concluded that integrating body movements into mathematics lessons can affect students' selective attention by influencing their cognitive systems.

In line with the research findings, the Easy Minds educational method, compared with the control group, is effective in improving the third component of executive function, namely cognitive flexibility, in children with mathematics learning disorder. This finding is consistent with the results of studies by AL-Onizat & Al-Qatawneh (2019), Clark (2023), and Wilkinson et al. (2020). This finding can be explained based on cognitive flexibility theory (de Santana et al., 2025). From this theory's perspective, effective learning is context-dependent and requires highly specific instruction. In addition, cognitive flexibility theory emphasizes the importance of structured knowledge, and for learners to learn appropriately, they must have the opportunity to develop their own representations. The combined effect of these factors is increased flexibility among students (Malekpour & Aghababaei, 2013). A memory training program can provide students with a new experience and break the usual vicious cycle arising from the outcomes of their thoughts and behaviors, so that they may consider possibilities beyond negative prejudgments and reduce the tendency to generalize failures to all situations. This, in turn, improves students' flexibility (AL-onizat & Al-Qatawneh, 2019). Moreover, regarding the effectiveness of Easy Minds on cognitive flexibility skills, it can be explained that the higher individuals' level of awareness, the deeper their understanding of their emotions, strengths, weaknesses, and needs. They are then better able to evaluate and control themselves, life events, and surrounding situations. This ability plays an important role in awareness of the surrounding environment and increases individuals' adaptability. According to Örün & Sever (2025), aerobic activity significantly enhances flexibility (Lezak, 2004). Based on learning-developmental mechanisms, exercise and physical activity create experiences for individuals that provide a context for the development of cognitive flexibility. These experiences achieve this through stimulating cognitive development. The learning levels of students with learning disabilities differ from those of typically developing children, underscoring the need to attend to how educational content is presented to these students. In other words, it can be argued that body movements activate different parts of the brain, leading to improved performance in retrieval and situational recognition (Ghorbanzadeh et al., 2015). Therefore, it can be argued that body movements activate different parts of the brain, enabling better retrieval and situational recognition. According to Piaget, gaining experience and manipulating the environment, which are consequences of movement, can affect cognition and cognitive ability. In other words, cognitive flexibility activities change in line with an individual's motor activities (Ghorbanzadeh et al., 2015).

Another important finding of the present study was the improvement in mathematics self-efficacy resulting from Easy Minds training and the stability of this effect up to two months after the end of the educational sessions. These results are consistent with the findings of Samuel & Warner (2021) and Simamora (2018). In explaining this hypothesis, it can be said that because emotions and emotional games play an important role in life, and because Easy Minds, as a therapeutic method for emotion regulation, is associated with self-esteem and positive social interactions and leads to effective coping with stressful situations and increased activity in response to social situations, Easy Minds training can play an important role in reducing physical symptoms, anxiety, depression, and impairment in social functioning, as levels of mental health, by making students with mathematics disorder aware of their problems and helping them accept and express them appropriately. In addition, because high levels of positive emotions and reduction of negative emotions play an important role in judgment, planning, and positive self-perception (Ruffini et al., 2024), Easy Minds training leads to the regulation of positive and negative emotions and, subsequently, to the regulation of judgment and positive self-perception in students with mathematics disorder. This, in turn, can be effective and useful in reducing impaired mental health scores, anxiety, depression, and related problems in these students. It is also worth noting that the effects of physical activity on cognitive functions can be examined in two time frames: immediate (Pontifex et al., 2009) and long-term (Hillman et al., 2014). It seems that the part of the brain responsible for processing movement is also involved in analyzing learning. On the other hand, we know that the brain does not have only one motor center. The cerebellum, which plays a role in all human learning, is stimulated by physical activities. Therefore, movement and learning have a continuous, reciprocal relationship. Thus, it can be concluded that thinking and mental activities are inseparable from basic motor activities and abilities (Behmard et al., 2013). Regarding the improvement of mathematics self-efficacy skills, Clemente et al. (2024); Hammad et al. (2022); Nielsen & Moore (2003); Siegle & McCoach (2007); and Zakariya (2022) showed that mathematics instruction integrated with physical activity, compared with regular mathematics instruction, leads to greater self-efficacy in mathematical skills. The ongoing relationship between physical education and other school subjects represents a model of integrated teaching that warrants further development (Rodić, 2014). With the coordination of the body and brain through motor skills, coordination, memory, reading, speaking, language, and mathematical skills improve, ultimately leading to students' self-efficacy (Chaouachi et al., 2017). Chaouachi et al. (2017) showed that playing is more effective than instruction alone in improving mathematical performance. In addition, it also promotes a positive attitude toward school subjects. New educational designs support the integration of subjects and consider it a factor that deepens learning. In the Easy Minds intervention, mathematics was also combined with exercise; in other words, both the freshness of physical education class and mathematics instruction were present. It seems that these two factors together deepened learning, improved mathematics scores, and increased students' self-efficacy in mathematics.

Overall, based on the findings of the present study, it can be concluded that Easy Minds educational programs are among the most effective methods for improving executive functions and mathematics self-efficacy in children with mathematics learning disorder. Many school-age children do not have pleasant memories of mathematics and consider it one of the most difficult school subjects; they still wish this subject could be removed from schools and education. Therefore, the above educational program, by providing an enjoyable environment that makes mathematics pleasant, makes mathematics lessons and the school environment enjoyable for students with learning disorders. Accordingly, based on the study's results, it is recommended that Easy Minds training be taught to counselors and therapists working with children with mathematics learning disorders, so they can take an effective step toward promoting these children's health and use these therapeutic methods in the long term. On the other hand, because this educational method presents instruction as a set of processes accompanied by physical and mental activities, it can help teachers improve the quality of instruction and, consequently, academic performance. The limitations of the present study include the short duration of training sessions, the lack of precise control over the severity of participants' disorders, individual differences among participants, and the limitation of the sample to children with mathematics disorder. Therefore, it is suggested that in future studies, to obtain more accurate findings, the medications used by children with mathematics learning disorder should be controlled across training groups. It is also recommended that future researchers use a larger sample size so that individual differences among students can be taken into account and the obtained findings can be interpreted more accurately. Considering the effect of the above educational methods in reducing psychological problems among children with mathematics learning disorder, it is recommended that all teachers, educators, psychologists, and relevant specialists use this program as a selected therapeutic method in psychotherapy centers.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this study.

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