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Comparison of the Effectiveness of Game-Based Therapy and Game-Based Therapy Integrated with Cognitive Rehabilitation on the Math Performance and Attitude towards Mathematics in Students with Learning Disabilities

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Abstract: The aim of this study was to compare the effectiveness of game-based therapy and game-based therapy integrated with cognitive rehabilitation techniques on the math performance and attitude of students with mathematical learning disabilities (MLD). A pre-test post-test quasi-experimental design was utilized to investigate the impact of independent variables on the dependent variable, with the use of a control group. The statistical population of the study consisted of male students with MLD in third to sixth grades from a school in Khomeynishahr, Iran, in 2020. A purposive sampling method was used to select 36 students with MLD, who were randomly assigned to three groups, including an experimental group receiving game-based therapy, an experimental group receiving game-based therapy integrated with cognitive rehabilitation techniques, and a control group receiving no intervention. Shalev arithmetic disorder scale and Aiken's mathematics attitude scale was used to collect data. MANCOVA was used to test the hypotheses. The findings revealed that game-based therapy and game-based therapy integrated with cognitive rehabilitation techniques significantly improved the math performance and attitude of the students ($p < 0.05$). Additionally, game-based therapy integrated with cognitive rehabilitation techniques was found to be more effective in improving math performance compared to game-based therapy alone ($p < 0.05$), while no significant difference was observed between the two interventions in improving attitude ($p = 0.792$). Therefore, it can be concluded that integrating game-based therapy with cognitive rehabilitation techniques can be more effective than other interventions in improving the math performance of students with MLD.

Keywords: Mathematical learning disabilities (MLD), Attitude towards mathematics, Game-based therapy, Math performance, Cognitive rehabilitation

Introduction

Learning disabilities are a major contributor to poor academic performance, resulting in a significant number of students struggling with academic subjects each year (Pennington et al., 2019). Despite having average or above-average intelligence, these students experience weaker academic performance compared to their peers in almost identical educational environments. They are unable to learn specific areas such as math, reading, and writing, despite being in a suitable educational environment and having no significant biological, social, or psychological issues (Karande et al., 2009). Specific learning disorder with impairment in mathematics is a neurodevelopmental disorder that causes continuous

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problems in understanding numbers, remembering mathematical facts, accuracy or fluency, calculation, and logical reasoning (Schulte-Körne, 2014). According to DSM-5, students with specific learning disorders in mathematics exhibit significantly lower performance on standardized math tests than expected based on their chronological age and intellectual abilities, which should seriously impact their academic progress and daily life. Additionally, math disorder should not be due to visual, hearing, physical, emotional, or inappropriate environmental, cultural conditions with educational institutions.

Students with specific learning disabilities encounter significant challenges in learning mathematics, particularly in problem-solving (Xin et al., 2005). Compared to typical students, they tend to make more mistakes when solving problems that require additional information or multiple steps to reach a solution (Powell, 2011). These students have deficits in memory, attention, background knowledge, vocabulary range, language processing, knowledge of strategies and how to use them, spatial-visual processing, and self-regulation. A disorder in any of these areas can adversely affect their performance in mathematics and reading (Jitendra & Star, 2011).

When a student's academic performance falls short of their potential, which is also known as academic dropout, it is considered undesirable and can result in poor academic performance (Manouchehri Ardestani et al., 2011). Even gifted students may experience academic dropout, so understanding this concept is crucial for understanding academic progress. If a student's learned skills in a particular subject match their potential and abilities, and there is no gap between their potential and their actual performance, then they have achieved academic progress (Ghasemi & Ahadi, 2018). Academic progress refers to a student's learned abilities in academic subjects, which are measured by standardized tests.

Learning disabilities can significantly impact a student's academic performance and lead to academic decline and failure. Without proper treatment, these disabilities may become chronic and persist into later stages of life (Walda et al., 2014). Learning disabilities in children can result in severe consequences, such as behavioral problems (Mariño et al., 2018), attention problems (Maehler & Schuchardt, 2016), academic dropout, dropping out of school, and difficulties in social and teacher-student relationships (Lipka et al., 2019). Early identification and intervention of learning disabilities are crucial to prevent long-lasting problems that can hinder a child's future development (Zhang et al., 2019).

Attitude is a contributing factor that worsens math learning disorders (Niepel et al., 2018). Some scholars have defined attitude towards math as merely liking or disliking the subject, while others have extended it to include beliefs, abilities, and the practicality of math (Zan & Di Martino, 2007). Mensah et al. (2013) have viewed attitude towards math as multidimensional. Considering the significant role of academic attitudes in students' academic success, it is crucial to recognize attitude as a notable factor in

math performance and difficulties (Colomeischi & Colomeischi, 2015). A positive attitude towards math enhances students' psychological well-being, self-motivation, self-esteem, independence, and mental health (Burrus & Moore, 2016). Some studies suggest that the link between attitude and progress is weak and not very practical (Usher & Pajares, 2009). Additionally, math learning disorders can be associated with attitude, and initial math homework struggles and failures can negatively impact students' motivation and interest (McDonald, 1989).

Math learning disorders, along with other learning disabilities, have long been a concern for psychologists and medical experts, who have continuously sought effective ways to improve educational outcomes and treat those affected. Play is a valuable tool in helping children comprehend phenomena, relationships, and feel comfortable in any situation. The objective of play is to establish its role and importance in treatment, making it a technique for diagnostic and therapeutic purposes (Landreth, 2013). Research conducted by Jordan et al. (2010) and Geary (2010) have revealed the positive effects of play in enhancing academic performance among children with math learning disorders. (Ota & DuPaul, 2002) theories on the impact of play in teaching math to children with math learning disorders are noteworthy. Heidari et al. (2018) have also demonstrated the beneficial effects of play therapy in improving the learning of mathematical concepts and problem-solving skills among students with math learning disorders. Furthermore, research conducted by Bigdeli et al. (2017) has shown that math problem-solving education based on games enhances problem-solving skills among students with math learning disorders. In some instances, play can be more beneficial than reading books, as children can acquire new mental concepts and skills through educational games. For this reason, some educators advocate that all educational materials should be taught to children solely through play (Mohammad Ismail, 2004).

To begin with, it can be argued that executive functions are key vulnerabilities and treatment factors in math learning disorders, leading to increased attention towards them in children in recent decades (Casas et al., 2009). Executive functions refer to a broad term that encompasses complex cognitive processes necessary for tackling challenging or novel tasks (Smith-Spark et al., 2016). Specifically, executive function comprises a set of activities that are intricately organized to guide cognitive and emotional functions and manage the behavioral performance details during mathematical problem-solving activities (Ribner et al., 2017).

As a result, executive functions are a central issue that significantly contributes to the vulnerability, persistence, and worsening of math learning disorders. These disorders have a neurocognitive basis and a developmental trajectory that starts before elementary school and carries on into adulthood (Gartland

& Strosnider, 2020). Memory problems are among the areas associated with executive function disorders. Memory, especially working memory, is also a vital learning factor (Soares et al., 2018). Consequently, executive function disorders, such as deficits in short-term and working memory, mild impairments in decoding, and cognitive and metacognitive strategies, are other significant characteristics of children with learning disabilities (Taroyan et al., 2007).

Attention is a crucial high-level mental activity that plays a vital role in intelligence, memory, and perception, and attention deficit is one of the primary components of learning disabilities. Research suggests that children with learning disabilities perform poorly in visual search tasks compared to their typically developing peers. Some studies even indicate that attention deficits persist into adulthood in individuals with learning disabilities. Garcia et al. (2007) demonstrated that children with learning disabilities have lower selective auditory attention abilities than typically developing children.

The ability to retain information in place or to switch between tasks easily is inversely related to mathematical ability, particularly when the inability to perform arithmetic operations is caused by a significant defect in executive function (Janeh et al., 2012). As a result, impaired executive function can be considered a primary factor in the development, persistence, and worsening of math learning disorders in children (Cragg & Gilmore, 2014). To address this issue, cognitive remediation can be used as a targeted intervention to improve and correct executive function. Cognitive remediation is a unique therapeutic approach that aims to improve cognitive impairments and functions, such as memory, executive function, social perception, concentration, and attention. It is a specialized type of treatment that focuses on cognitive abilities. Studies have shown that cognitive remediation can effectively improve the performance of students with math learning disabilities, such as in Aghei (2017) study on the effectiveness of cognitive rehabilitation methods for verbal and visual-spatial working memory. Ardila and Rosselli (2019) found that cognitive rehabilitation had a significant impact on problem-solving, math anxiety, and math self-efficacy in 30 children aged 8 to 12 years with math learning disabilities. Rubinsten (2015) also reported that cognitive rehabilitation is an evidence-based intervention for treating math disabilities, according to a review of studies conducted from 2002 to 2013. The points made suggest that play therapy is a specialized approach for children that not only corrects behavior but also enhances attitudes and beliefs by aligning with their unique abilities and performance. However, it remains uncertain whether play therapy can be effective in treating math learning disabilities, which are linked to deficiencies in executive functions. Essentially, can cognitive rehabilitation help repair and improve executive functions? This question can forecast the durability of treatment in addition to the treatment results. Thus, cognitive rehabilitation can be used as a supplementary intervention to restore and enhance executive functions. The present study aims to

compare the effectiveness of game-based therapy alone versus game-based therapy integrated with cognitive rehabilitation techniques in enhancing attitudes towards math and math performance in students with math learning disabilities. So, the main hypotheses are: 1. The effectiveness of game-based therapy integrated with cognitive rehabilitation techniques is different from that of game-based therapy alone in improving attitudes towards math in students with math learning disabilities and 2. The effectiveness of game-based therapy integrated with cognitive rehabilitation techniques is different from that of game-based therapy alone in improving math performance in students with math learning disabilities.

The sub-hypotheses are: 1. Game-based therapy alone is effective in enhancing attitudes towards math in students with math learning disabilities. 2. Game-based therapy integrated with cognitive rehabilitation techniques is effective in enhancing attitudes towards math in students with math learning disabilities. 3. Game-based therapy alone is effective in improving math performance in students with math learning disabilities and 4. Game-based therapy integrated with cognitive rehabilitation techniques is effective in improving math performance in math in students with math learning disabilities.

Material and Methods

This study is applied research that used a semi-experimental design with a pre-test/post-test multi-group format. The research focused on male students in grades three to six at Noor Danesh School in Khomeynishahr (Iran) during the academic year of 2020 who had math learning disabilities. The teachers, with the help of the school counselor, identified students who had normal intelligence and no physical or sensory issues but had low math progress and scores below their expected level based on DSM-5 criteria. Teachers were selected for initial screening due to their experience teaching math to these students and access to their academic and health records. The 45 identified students were referred to the education and rehabilitation counseling center of the city, where they underwent physical and sensory health examinations, and the Wechsler intelligence test was administered to confirm normal intelligence. The Shalev arithmetic disorder scale was then given as a pre-test, and students with scores below the threshold despite having average or above-average intelligence and physical health were identified as having math learning disabilities. The study recruited 36 such students, who were randomly assigned to one of three groups: experimental group 1, experimental group 2, or control group. All three groups were evaluated based on the research assessment scale, and their math performance was recorded as a pre-test. The experimental groups underwent eight 45-minute sessions of game-based therapy and game-based therapy integrated with cognitive rehabilitation techniques over a month, following the

principles of play therapy. The control group received no psychological or drug interventions. After one month of treatment, all three groups were re-evaluated using the research assessment scale. The exclusion criteria were defined as missing more than one session of the educational program and parents not consenting to their child's participation in the study.

Instruments

Shalev arithmetic disorder scale: This scale was developed by Gross-Tsur et al. (1996) based on McCloskey et al. (1985) numerical processing model for diagnosing math learning disabilities and evaluating mathematical progress. It is commonly used to diagnose math learning disabilities and has three sections: The first section assesses numerical understanding, with eight subtests covering counting, comparing, matching, reading, writing, using symbols, and arranging numbers. The second section evaluates numerical production, including subtests for basic arithmetic operations. The third section measures numerical calculation, featuring subtests for multi-digit operations. Each section has five questions, and the total score is 100, making it a benchmark test. The test demonstrated a reliability of .92 on a sample of 703 individuals (Gross-Tsur et al., 1996). The Persian translation of the test by Barahmand et al. (2007) reported a reliability coefficient of .95 using Cronbach's alpha.

Aiken's mathematics attitude scale: The Attitude Toward Mathematics Questionnaire (ATMQ) (Aiken Jr, 1970) comprises 24 Likert scale items, with 12 positive and 12 negative statements on students' perceptions of mathematics. The items are scored from 1 to 5 and cover four components: enjoyment, importance, motivation, and fear/anxiety. The total scale reliability was .90, and the test-retest method yielded a reliability of .94 (Aiken, 2009). The tool's reliability was also confirmed in various studies for different samples (Olson, 2002; Wong, 2001). Razavieh et al. (2005) standardized and validated this scale in Iran. In this study, the tool's reliability was .81 based on Cronbach's alpha for 200 participants (24 items). The tool's reliability was .78 and .84 for male and female participants, respectively, and .79 and .83 for participants in the humanities and sciences, respectively. The correlation between the anxiety questionnaire and this tool was -.36, indicating concurrent validity. Factor analysis was used to assess the tool's construct validity. The acceptable limit for factor analysis for questionnaire items is at least .30. The Cronbach's alpha coefficient for the total scale in this study was .86 indicating strong reliability of this tool.

Interventions

The study employed eight 45-minute sessions of game-based therapy (Mohammad Ismail, 2004) and eight 45-minute sessions of game-based therapy integrated with cognitive rehabilitation (Dehn, 2008). Tables 1 and 2 provide a summary of the game-based therapy sessions and game-based therapy integrated with cognitive rehabilitation sessions.

Table 1. Summary of the game-based therapy sessions

Session	Title	Title
1	Getting to know and encouraging children to cooperate with each other and group meeting activities	Explaining the types of emotions, thoughts and behaviors, providing examples from children's daily life, and also providing exercises to familiarize with the types of emotions and the symptoms of each emotion in people
2	Increasing interpersonal and group skills	Investigating the benefits of communicating with others and doing group work compared to individual work, strengthening the important role and position of people in group activities, dividing work, facilitating things in work at home and dealing with the selected activity of the meeting.
3	Strengthening and teaching verbal and non-verbal skills	Two-person exercises on how to communicate, self-expression exercises, boldness, conversation etiquette and requests, as well as group exercises and group discussions on types of communication and the role of non-verbal communication, including body language and its role in communication.
4	Increase self-awareness skills	In this session, while maintaining attention on certain objects or activities, children should try to remember them. In fact, the purpose of these types of games is to maintain and pay attention for a longer period of time.
5	Examining and strengthening the abilities and strengths of each child compared to his past	Presenting a real situation of everyday life of children, practicing and presenting different situations of children
6	Identifying the four main emotions of sadness, fear, happiness, anger	Expressing emotional experiences in the correct way, teaching self-monitoring skills to identify and record different emotions in a weekly program.
7	Reviewing the child's emotional experiences during the week	In this session, in order to improve children's thoughtless behaviors, they are asked to evaluate themselves before playing the game while playing it and after doing it.
8	Increase coping skills	Running inside the maze and talking about the games that are played in this session, also mentioning the types of games in the form of different emotion regulation strategies.

Table 2. Summary of the game-based therapy integrated with cognitive rehabilitation sessions

Session	Title	Content
1	Pointing to the role of active memory in doing math tasks and emphasizing auditory memory	Teaching the activities of carrying out commands, following commands, memorizing a few numbers and simple words, memorizing very short children's poems, teaching the emphasis on visual memory: including teaching to hide one of the objects, identifying deleted objects, remembering seen objects, repeating patterns and models
2	Play with pictures	Students are shown pictures and then asked to name the colors and directions after 15 seconds.
3	Recognition memory	Students are shown pictures of children, animals, fruits and objects and they have to recognize them after a few seconds.
4	Recall memory	A story or a short story is read to the students in a few minutes (maximum three minutes) and the students must retell that story or story.
5	Long-term memory	In this session, students are asked to tell the instructor the events of the previous 24 hours in full detail
6	Review technique	Teaching mental review technique (repeated reading and writing) especially regarding math exercises
7	Sit and walk in a direct and reverse way	Students should execute the sudden orders of the examiner immediately and collectively and after learning, do it in reverse and practice the training of the previous session.
8	Direct and reverse memory games	The student should first say the names of the objects presented by the examiner directly and then the new names in reverse, and then practice the lessons of the previous sessions.

Results

The game-based therapy group had a mean intelligence score of 89.41 ± 4.92, while the game-based therapy group integrated with cognitive rehabilitation techniques had a mean score of 86.57 ± 4.64 and the control group had a mean score of 87.75 ± 4.78. based on it, there was no significant difference in intelligence among the group. Table 1 shows the descriptive statistics of the research variables in the

three groups. According to Table 1, the mean scores of the game-based therapy group and the game-based therapy integrated with cognitive rehabilitation had significant changes compared to the pre-test in the post-test stage. This change was not observed in the control group.

Table 1. Descriptive statistics of research variables in pretest and posttest in experimental and control groups

Variable		Game-based therapy		Cognitive rehabilitation		Control	
		Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Math performance		11.25 ± 2.34	14.91 ±1.78	10.1 ± 1.85	6.75 ± 1.31	10.41 ± 1.67	10.25 ± 1.65
Attitude	Enjoyment	13.50 ± 2.29	16.33 ± 3.54	12.33 ± 3.22	17.41 ± 3.11	12.75 ± 2.26	12.16 ± 2.87
	Importance	9.58 ± 1.08	12.75 ± 3.11	9.5 ± 2.11	14.08 ± 2.91	9.83 ± 2.49	9.50 ± 1.32
	Motivation	10.41 ± 2.18	14.16 ± 3.76	10.16 ± 3.13	13.14 ± 2.17	10.58 ± 1.28	10.66 ± 2.31
	Fear of mathematics	16.08 ± 2.64	11 ± 2.13	15.93 ± 2.58	10.08 ± 2.43	17.33 ± 1.49	16.66 ± 1.82
	Total	49.58 ± 5.01	54.25 ± 3.74	48.03 ± 6.43	55.75 ± 4.49	50.49 ± 3.11	49.02 ± 2.95

The *MANCOVA* was used to measure and compare the effectiveness of the two experimental groups. Before conducting the *MANCOVA*, the normality assumption and homogeneity of variances of the variables related to attitude towards mathematics and mathematical performance were examined using the Shapiro-Wilk and Levene's tests. The results indicated that these assumptions were confirmed. Table 2 presents the results of the *MANCOVA*. According to Table 2, there was a significant difference in the attitude towards mathematics and mathematical performance between three groups.

Table 2. MANCOVA results

Source	Variables	SS	DF	MS	F	p	Eta	Power
Pretest	Attitude towards mathematics	33.74	1	33.74	3.46	.12	.071	.33
	Math performance	49.45	1	49.45	31.68	.001	.49	1
Group	Attitude towards mathematics	296.207	2	148.103	10.80	.001	.40	.98
	Math performance	265.284	2	132.642	84.96	.001	.84	1

The follow-up Tukey test was used to investigate the research hypotheses. The results are presented in Table 3. Based on Table 3, both game-based therapy group and the game-based therapy integrated with cognitive rehabilitation techniques had a significant effect on improving the attitude towards mathematics and mathematical performance. The results of comparing the effectiveness of the two intervention groups in this study showed that the game-based therapy group integrated with cognitive rehabilitation techniques had a greater effectiveness in improving mathematical performance, but no significant difference was observed in the attitude towards mathematics variable between the two experimental groups.

Table 3. Tukey's test results of attitude towards mathematics and mathematical performance

Variable	Group	Compare to	Mean difference	p	Eta
Attitude towards mathematics	Game-based therapy	Cognitive rehabilitation	-1.50	.60	.071
	Game-based therapy	Control	5.25*	.005	.47
	Cognitive rehabilitation	Control	6.75*	.001	.60
Math performance	Game-based therapy	Cognitive rehabilitation	-1.83*	.037	.36
	Game-based therapy	Control	4.66*	.001	.49
	Cognitive rehabilitation	Control	6.50	.001	.67

Table 4 presents the results of the Tukey test to examine the post-test components of attitude towards mathematics in the three groups of game-based therapy group, game-based therapy integrated with cognitive rehabilitation and control. As can be seen, the results of comparing the post-test components of attitude towards mathematics, including enjoyment, importance, motivation, and fear of mathematics, in the three groups indicate that both game-based therapy group and the game-based therapy integrated with cognitive rehabilitation had a significant effectiveness in improving the attitude towards mathematics of students with math learning disabilities. Additionally, no significant difference was found between the two intervention groups in this regard.

Table 4. Tukey test results of attitude towards mathematics components

Variable	Group	Compare to	Mean difference	p	Eta
Enjoyment	Game-based therapy	Cognitive rehabilitation	-1.80	.12	.05
	Game-based therapy	Control	4.17*	.001	.53
	Cognitive rehabilitation	Control	5.25*	.001	.49
Importance	Game-based therapy	Cognitive rehabilitation	-2.05	.25	.11
	Game-based therapy	Control	3.25*	.001	.64
	Cognitive rehabilitation	Control	5.30*	.005	.54
Motivation	Game-based therapy	Cognitive rehabilitation	1.02	.71	.06
	Game-based therapy	Control	3.50*	.001	.65
	Cognitive rehabilitation	Control	2.48*	.001	.59
Fear of mathematics	Game-based therapy	Cognitive rehabilitation	.20	.10	.03
	Game-based therapy	Control	-5.66*	.001	.57
	Cognitive rehabilitation	Control	-6.58*	.001	.61

Discussion

The main objective of this study was to compare the effectiveness of game-based therapy alone and game-based therapy combined with cognitive rehabilitation methods in terms of attitudes towards mathematics and math performance in students with learning disabilities. The results revealed that game-based therapy integrated with cognitive rehabilitation methods was more effective in improving the math performance of students with learning disabilities in mathematics compared to game-based therapy alone, which is consistent with prior studies. However, there was no significant difference in attitudes towards mathematics between the two experimental groups.

Regarding the first sub-hypothesis, the data analysis showed that game-based therapy had a positive impact on attitudes towards mathematics, including enjoyment, importance, motivation, and fear, which

is in line with previous research. Play is a natural way for individuals to express themselves and cope with negative experiences, and it provides an opportunity for children to adapt to new situations.

For the second sub-hypothesis, the data analysis showed that game-based therapy integrated with cognitive rehabilitation methods was effective in improving attitudes towards mathematics and its components, due to the fact that executive functions are typically weak in students with learning disabilities. As such, cognitive empowerment training can be used to enhance inhibitory response, change, and update abilities, leading to improved learning outcomes.

For the third sub-hypothesis, the results indicated that game-based therapy alone was effective in enhancing the mathematical math performance of students with learning disabilities, which is consistent with prior studies. Children need to master certain skills, such as neuropsychological aspects, memory, accuracy, and attention, to perform mathematical calculations and operations, and game-based therapy provides an effective means of doing so.

The data analysis for the fourth sub-hypothesis indicated that game-based therapy combined with cognitive rehabilitation methods was effective in enhancing the math performance of students with learning disabilities in mathematics. This finding aligns with the results of previous studies conducted by Aghei (2017), Abbariki et al. (2017), Bigdeli et al. (2017), Narimani et al. (2015), Narimani and Soleymani (2013), and Ardila and Rosselli (2019). The challenges posed by working memory deficits are among the most significant obstacles for students with math learning disabilities, which can hinder their ability to regulate various stimuli and respond effectively. Cognitive rehabilitation can positively influence the performance of higher brain levels that are responsible for executive processes such as attention, resulting in better organization of students' perceptual attention to stimuli and the environment. This, in turn, facilitates the processing, interpretation, integration, and relation of spatial and temporal aspects of sensory inputs, enabling the brain to select, strengthen, inhibit, and compare information and present it in a versatile and adjustable pattern (Iwanaga et al., 2006).

The improvement in academic progress of students with math learning disabilities can be attributed to the enhancement of cognitive flexibility, response inhibition, working memory, sustained attention, and problem-solving abilities, which are vital factors in learning and teaching, particularly in math. The training of executive functions and attention-based game therapy can lead to an increase in these abilities, resulting in a corresponding improvement in academic progress. Cognitive rehabilitation facilitates the differentiation of selective attention by adding distracting visual and auditory stimuli, related and unrelated stimuli, and presenting them simultaneously. The use of different tools in the cognitive rehabilitation program for each exercise prevents monotony and repetition, leading to improved attention, memory, and problem-solving abilities through games and competitions. The

engaging appearance of these games boosts children's emotion and reduces their fatigue, and the time limit encourages more effort, leading to increased speed and efficiency. The short duration of each task minimizes the risk of fatigue (Gaitán et al., 2013).

In conclusion, cognitive rehabilitation, which includes brain training programs, can improve cognitive and mental functions, and combining it with game-based therapy is more effective in enhancing the academic progress of students with math learning disabilities than using only game-based therapy. However, there is no difference in terms of attitude towards math between game-based therapy and game-based therapy integrated with rehabilitation methods, although both methods are effective in improving this attitude.

One limitation of this study is the inability to control external factors such as family and financial circumstances that may influence participants. Additionally, since the treatment was administered to elementary school students, the generalizability of the results to other educational levels is limited, and the findings can only be applied to this specific group. The study suggests that attention-based games are an effective tool to be designed and implemented in schools for students with learning disabilities. Therefore, it is recommended that managers and coaches of learning disability centers create educational environments rich in attention-based games to maximize their use by math learning disabled students and enhance their executive functions and attention, which are essential prerequisites for academic success.

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