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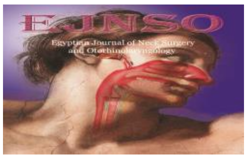

Adaptation and Application of A Rehabilitation Program for Dyscalculia In Egyptian Children

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Abstract:

Background: The term "dyscalculia" refers to a specific learning disability in mathematics, where the mathematical ability of the respective child is significantly below what one would expect in terms of age, intellect, and education, and seriously impedes academic achievement or daily life .

Objectives: The objective of this study is to adapt the "Basic Math Practice COMBO" program to test its effectiveness on Egyptian children with dyscalculia.

Patients and Methods: In this study, the participants were 50 school-age children from both sexes diagnosed with dyscalculia and were being treated at the Unit of Phoniatrics at Alexandria Main University hospital. Translation and adaptation of the "Basic Math Practice COMBO" was done. Application of the studied program with pre and post intervention assessment

Results: statistically significant improvement of pre and post intervention scaled scores of TOMA3 (Test of Mathematical Abilities-Third Edition) subtests: Mathematically related Symbols and Concepts, Computation, Everyday Life Mathematical situations, Word Problems, and the supplemental test: Attitude Toward Math.

Conclusion: This study showed effectiveness of remediation program as regards improvement of math symbols & concept, computation, math in every-day life, word problem and percentile rank. Improvement of Arabic version of TOMA3 of dyscalculia assessment post intervention .

Key words: dyscalculia, learning disability, mathematical difficulty, ADHD, dyslexia.

Introduction

Dyscalculia is a disorder which is characterized by learning impairment in mathematics, where the mathematical ability of the respective child is significantly below what is expected in terms of age, intellect, and education, and substantially impairs everyday life or academic performance. It could be attributed to a disability involving abstract reasoning within different parts of the brain (comprising visual processing regions, particularly in the parietal cortex, and circuits that are language-related in the brain). [1]

The prevalence of Dyscalculia ranges from 5% to 8% globally, while the prevalence rate in higher education could be as high as 11%. [2-3]

Sixty eight percent of students studying mathematics at higher

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educational institutions are experiencing a high level of mathematics anxiety, and therefore it is considered as a major problem needing urgent attention and academic support. [3]

There are different factors that cause or exacerbate dyscalculia involving: neurologically related disorders, insufficient functional memory, and genetics, teaching issues, poor environmental learning and math anxiety. [4-8]

Classification of Dyscalculia

A. **Sharma, 2015** demonstrated three types of dyscalculia:
   - Quantitative Dyscalculia: the counting and calculation abilities are lacking.
   - Qualitative Dyscalculia: difficulty in understanding instructions, or failure to master the skills needed for an operation are noted.
   - Intermediate Dyscalculia: being unable to handle functions involving symbols or numbers, as <, >, t, -, x, ÷, √, on a piece of paper. [9]

B. **Kosc, 1974** divided dyscalculia into six categories as following: verbal, practognostic, lexical, graphic, indignostic, and operational dyscalculia. [9]

C. Another classification is Developmental vs Acquired where Developmental Dyscalculia (DD) refers to people of school age who first encounter mathematical knowledge and skills, while the Acquired Dyscalculia applies to people who have learned mathematics but then lose this ability in adolescence or more often in adulthood due to some acquired brain-related disability. [10]

Dyscalculia is diagnosed using a combination of clinical examination, extensive history-taking, psychosocial assessment, and psychometric (mathematic) testing. [11]

Despite being just as prevalent as dyslexia, dyscalculia is less well-known among teachers, parents, school staff, and government officials. Learners with dyscalculia should get the same special education as those with dyslexia. Language and memory deficits were found that they can trigger problems in acquiring mathematics and literacy skills. [12]

According to estimates, 40% of dyslexic youngsters may also have trouble learning math. [13]

It has also been documented that DD and ADHD co-exist in many individuals; about 25% of children with DD also have ADHD. [14]

All suggested interventional approaches for dyscalculia must be tested objectively with respect to their materials and the ideas they represent for treatment. There may be differences in the treatment plan because there are no evidence-based therapy programs available for all age groups. Problematic areas of mathematics performance identified by the diagnostic test serve as the primary therapeutic intervention targets. [11]

Aim of the work

The objective of this study is adapting the "Basic Math Practice COMBO" program and testing its efficacy in rehabilitating Egyptian children with dyscalculia.

Patients and methods:

Patients: In this study, 50 dyscalculic children who were patients at the Phoniatrics Unit outpatient clinic at Alexandria Main University hospital were included.

Inclusion criteria:

1. Children within the ages of 8 and 15 who report having dyscalculia, of both sexes.
2. Attention deficit hyperactivity disorder (ADHD) suffering Children .

Exclusion criteria

1. Children who have suffered from brain injury, intellectual incapacity (mentally subnormality), and a history of both clinical and subclinical fits.
2. Impairment of the vision or hearing.
3. Autism spectrum disorders.

Methods

The study (n. 0106076) was authorized by the Faculty of Medicine ethics committee at Alexandria University (IRB NO: 00012098, FWA NO: 00018699).

Pre-post intervention study for the following quasi-experimental study was conducted in the following order :

I. **The remediation program Formulation**: The following procedures were used to translate and modify the "Basic Math Practice COMBO" Programme so that it may be utilised with dyscalculic Egyptian youngsters: [15]
  - Translating the program into the Arabic Language.
  - Changing the order of some items to fit the Egyptian mathematics content.
  - Modifying some items of the test to suit Arabic orthography and subsequently become suitable for Egyptian students.
  - Revising the modified Arabic versions of the program by one of the experts in the Ministry of Education, to ensure its compatibility with the Egyptian mathematics curriculum in various academic stages .

The "Basic Math Practice COMBO" program: [15] Is an evidence-based technique. It is a set of reproducible exercises designed to aid students in understanding fundamental mathematical concepts. Basic Math Practise provides children with a tool for enhancing their arithmetic ability and laying a solid mathematical foundation without necessitating on-level reading capabilities.

While many basic math programs give broad overviews of each fundamental math skill, Basic Math Practice takes a more individualized approach by addressing each concept in a number of forms with a range of activities. The series consists of six volumes, and each one has more than 100 tasks for teaching and practicing basic mathematical ideas. The series is arranged up according to the development's progression .

Age-appropriate ideas and exercises that are presented in Basic Math Practice at a low readability level aid in the academic success of children who have difficulty with reading. The activity papers also have a lot of visual illustrations and minimal text to help kids succeed and comprehend mathematical topics.

1. **Features:** The purpose of this series is to inspire and motivate students in learning basic mathematical skills who may have difficulty reading.

   Each series involved unit possesses the following features:

   - **Page of therapist instructions**: In order to assist the therapist, this page offers student-centered exercises that trigger prior knowledge of the students and create examples of mathematical abilities that students can understand.
   - **Warm-Up Exercises:** These quick activities usually just have one or two problems but are meant to focus students' attention on their mathematical teaching skills. Students can review prior topics from the programme and refresh their arithmetic skills with the aid of warm-up exercises. These activities also give the therapist a way to assess

the children's development and determine whether or not a lesson or skill needs to be taught.

- **Unit Worksheets**: These pages include easy directions, examples, and tasks that integrate visuals and problem-solving abilities.
- **Unit Assessments**: Such tasks help the therapist to gage the awareness and mastery of skills presented by the students in each lesson. Students can become more used to the formats of standardized tests by taking certain examinations.

2. **Series contents**

- **Book 1 number concept**: This includes the following concepts: place value, more than or less than, greater than or equal to, counting, ordinal numbers, shapes, and sequential patterns.
- **Book 2 number related operations:** Which contains: Addition, Subtraction, Multiplication, and Division .
- **Book 3 measurements**: Which contains: Linear, Weight, Capacity, Time.
- **Book 4 fractions, decimals, and percents**: Which contains: Fractions, Decimals, Percents.
- **Book 5 rounding, reasonableness, and estimation**: Which contain: Rounding, Reasonableness, Estimation.
- **Book 6 tables, graphs, and charts**: This includes tables, charts, graphs that may be pictographs, bar graphs, line graphs, and circle graphs.

The order is proposed as a series to address the mathematical competencies included in these books. However, the sequence in which the modules are taught might be changed to suit the needs of the students or the requirements of the curriculum.

Not all books were applied, the choice depended on the student's age and the skill weakness. for examples the first three books were very useful in all patients especially patients aged from 8 to 11 years whereas the other three books were useful for the older patients aged from 11 to 15 years.

A pilot study was conducted on 10 patients, they were randomly chosen. It was done after translation and modification of the program to check its suitability and clarity of the language of reading materials used for the Egyptian children.

II. Initial assessment was done for all participants of the studied group by the dyscalculia assessment protocol.

A. **Elementary diagnostic approaches**:

- Detailed present, historical, and family histories are taken, along with personal information, complaints, and symptom analyses.
- General assessment and thorough neurological assessment

B. Clinical diagnostic procedures

Psychometric examination

a. The fourth version of the Stanford Binet Scale is used to measure mental maturity and IQ. [16]

b. Study on children's adjustment and focus in circumstances when there are signs of ADHD. [17]

c. The Arabic dyslexia assessment test (ADAT) is employed for those who claim to have dyslexia symptoms. [18]

d. Evaluation of the mathematical problems based on the dyscalculia test's Arabic version TOMA-3). [19]

The TOMA-3 is designed to assess some of the areas of math that other instruments may not address. It features one supplemental subtest in addition to four core subtests. The four core subtests are: Mathematics Symbols and Concepts, Computation, everyday Mathematical Applications of in life, Word Problems, and the supplemental test: Attitude Toward Math

III. Intervention

Application of the "Basic Math Practice COMBO" remediation program: [15]

All patients in the study group received the programme in the form of group sessions with 2-3 children grouped by age, held twice a week for durations of 30 to 40 minutes each. The program was implemented at the faculty of medicine's unit of phoniatrics, located at the main university hospitals of Alexandria. The therapeutic course lasted for 3 months.

All children enrolled in the study obtained informed written consent from their parents or other legally responsible surrogate, in addition to providing their own written agreement .

IV. Post intervention assessment:

Re-evaluation of the patients by TOMA3 test after three months of training. [19]

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The data Statistical analysis: [20]

With the aid of the IBM SPSS software package version 20.0, data was input into the computer for analysis. (Armonk, NY: IBM Corp) (21) To describe qualitative data, numbers and percentages were employed. Using the Kolmogorov-Smirnov test, the distribution's normality was evaluated.

For the purpose of describing quantitative data, the range (minimum and maximum), mean, standard deviation, median, and inter-quartile range (IQR) were utilised. The relevance of the collected data was assessed using the 5% level.

A test for quantitative variables with anomalous distributions is Wilcoxon signed ranks, which is used to compare two periods.

Results

The Phoniatrics section of the Faculty of Medicine's Alexandria Main University Hospitals conducted this quasi-experimental study from June to December 2019.

1- Pilot study

A pilot study was conducted on ten randomly chosen children of the research group. The remedial program was implemented once it had been translated and modified to ensure that the language and reading materials were appropriate.

2- Demographic data

Children in the study sample varied in age from 8.0 to 14.75, with a median age of 10.58 and an inter-quartile range (IQR) (9.60 – 11.40). The distribution of children according to age was: 17 children < 10 years (34%), 24 children between 10- 12 years (48%), 9 children > 12 years (18 %).

In the groups under study, the ratio of the male to female was about 3:1, 38 males (76 %) and 12 females (24%).

3- Characteristics of the studied group

a- According to IQ

The IQR for abstract IQ was (90.0–100.3), with a median of 96 and a range of 87.0–130.0. The general IQ varied from 80.0 to 115.0, with a median of 90.0 and an IQR of (85.0 to 92.25).

b- According to type of school

35 children were attached to public schools (70.0%), 15 children were attached to private schools (30.0%).

c- According to comorbidity of dyscalculia with ADHD and dyslexia

10 children had ADHD (20.0%); 27 children had Dyslexia (54.0%).

4- **Comparison of formal testing using the TOMA 3 test for dyscalculia evaluation between the examined group before and after treatment**

i. **Scaled scored (SS) parameters *(Table 1):***

- With a median of 4.0 and IQR (3.0-6.0) pretherapy as opposed to a median of 6.0 and IQR (5.0-7.0) posttherapy, there was a a difference in the SS math symbols & concept in the study group before treatment and post therapy that was significant statistically (p= 0.001).
- There was difference with statistical significance among the SS of computation in the examined group's pre- and post-therapy (p= < 0.001) with a median of 7.0 and IQR (5.0-8.0) pretherapy as compared a median of 9.0 and IQR (7.0-10.0) post therapy.
- In the examined group, there was a difference that was significant statistically between SS maths in daily life before and after therapy (p= < 0.001) with a median of 5.0 and IQR (3.0-7.0) pretherapy as compared a median of 6.0 and IQR (4.75-7.25) post therapy.
- In the group under study, there was a significant difference statistically in the SS of word problems before and after therapy (p= < 0.001) with a median of 6.0 and IQR (4.0-7.0) pretherapy as compared a median of 7.0 and IQR (5.0-8.0) post therapy.
- In the studied group, there was a significant difference statistically between total SS before and after therapy (p= < 0.001) with a median of 20.5 and IQR (19.75-25.25) pretherapy as compared a median of 27.0 and IQR (24.75-29.50) post therapy.

ii. **Mathematical Index (Table 2):** In the examined group, there was a significant difference statistically among the index before and after therapy (p=< 0.001) with a median of 71.50 and IQR (70.50-78.25) pretherapy as compared a median of 81.0 and IQR (77.50-83.75) post therapy.

iii. **Percentile rank** (**Table 3**): There was statistically significant difference between percentile rank in the studied group pre therapy and post therapy (p= < 0.001) with a median of 3.0 and IQR (2.75-7.25) pretherapy as compared a median of 10.0 and IQR (6.50-14.25) post therapy.

iv. **Descriptive term** (**Table 4**): A statistically significant difference existed between the descriptive terms "pre therapy" and "post therapy." (p= < 0.001) with 12 children are very low (24.0%), 27 children are low (54.0%), 11children below average (22.0%), 0 children average (0.0%) pretherapy as compared 0 children very low (0.0%), 18 children low (36.0%), 21 children below average (42.0%), 11 children average (22.0 %) post therapy.

v. **Scaled score of attitude toward math** (**Table 5**): There was statistically significant difference between SS of attitude toward math pre and post therapy (p= < 0.001) with a median of 10.0 and IQR (8.75-11.0) pretherapy as compared a median of 11.0 and IQR (10.0-12.0) post therapy.

Table (1): A comparison of pre- and post-therapeutic outcomes using SS parameters (n = 50)

	Pre	Post	Z	p
SS math symbols &concept				
Min. – Max.	1.0 – 8.0	3.0 – 10.0	6.327*	<0.001*
Mean ± SD.	4.58±1.76	6.30±1.88		
Median (IQR)	4.0 (3.0 – 6.0)	6.0 (5.0 – 7.0)		
Change	**↑1.72 ± 0.61**			
% of change	**↑47.33 ± 38.13**			
SS of computation				
Min. – Max.	2.0 – 10.0	5.0 – 12.0	6.333*	<0.001*
Mean ± SD.	6.84 ± 1.92	8.52 ± 1.75		
Median (IQR)	7.0 (5.0 – 8.0)	9.0 (7.0 –10.0)		
Change	**↑1.68 ± 0.59**			
% of change	**↑28.95 ± 22.40**			
SS of math in everyday life				
Min. – Max.	3.0 – 9.0	4.0 –10.0	6.266*	<0.001*
Mean ± SD.	5.28 ± 1.91	6.14 ± 1.77		
Median (IQR)	5.0 (3.0 – 7.0)	6.0 (4.75 –7.25)		
Change	**↑0.86 ± 0.45**			
% of change	**↑20.05 ± 14.64**			
SS of word problem				
Min. – Max.	2.0 –11.0	3.0 –11.0	6.205*	<0.001*
Mean ± SD.	5.66 ± 1.92	6.56 ± 1.92		
Median (IQR)	6.0 (4.0 – 7.0)	7.0 (5.0 – 8.0)		
Change	**↑0.90 ± 0.54**			
% of change	**↑18.20 ± 12.51**			
Total SS				
Min. – Max.	16.0 – 32.0	20.0 – 39.0	6.209*	<0.001*
Mean ± SD.	22.40 – 4.90	27.66 ± 5.11		
Median (IQR)	20.5(19.75 – 25.25)	27 (24.75 – 29.50)		
Change	**↑5.26 ± 1.21**			
% of change	**↑24.42 ± 6.85**			

Z: Wilcoxon signed ranks test
p: p-value for comparing the pre- and post-conditions.
*: Statistical significance at $p \le 0.05$

Table (2): Comparison done according to index between both Pre and post therapy (n = 50)

Index	Pre	Post	Z	P
Min. – Max.	65.0 – 87.0	71.0 – 97.0		
Mean ± SD.	74.10 ± 6.86	81.48 ± 7.01	6.182*	<0.001*
Median (IQR)	71.50(70.50 – 78.25)	81.0(77.50 – 83.75)		
Change	**↑7.38 ± 1.79**			
% of change	**↑10.04 ± 2.55**			

Z: Test of Wilcoxon signed ranks
p: p-value for comparing the pre- and post-conditions.
*: Statistical significance at $p \le 0.05$

Table (3) Comparison between pre and post therapy according to percentile rank (n = 50)

Percentile rank	Pre	Post	Z	P
Min. – Max.	1.0 – 19.0	3.0 – 42.0	6.177*	<0.001*
Mean ± SD.	5.94 ± 5.79	13.14 ± 10.25		
Median (IQR)	3.0 (2.75 – 7.25)	10.0 (6.50 – 14.25)		
Change	**↑7.20 ± 4.97**			
% of change	**↑170.5 ± 77.95**			

Z: test of Wilcoxon signed ranks
p: p-value for comparing the pre- and post-conditions.
*: Statistical significance at $p \leq 0.05$

Table (4): Pre- and post-therapy comparison using a descriptive term(n = 50)

Descriptive term	Pre		Post		Z	p
	No.	**%**	**No.**	**%**		
Very poor	12	24.0	0	0.0	6.633*	<0.001*
poor	27	54.0	18	36.0		
Below average	11	22.0	21	42.0		
Average	0	0.0	11	22.0		

Z: Test of Wilcoxon signed ranks
p: p-value for comparing the pre- and post-conditions.
*: Statistical significance considered at $p \leq 0.05$

Table (5): pre and post therapy Comparison of the SS attitude toward math (supplemental) (n = 50)

SS attitude toward math (supplemental)	Pre	Post	Z	P
Min. – Max.	6.0 – 13.0	8.0 – 14.0	5.851*	<0.001*
Mean ± SD.	9.80 ± 1.75	11.22 ± 1.31		
Median (IQR)	10.0 (8.75 – 11.0)	11.0 (10.0 – 12.0)		
Change		**1.01±↑1.42**		
% of change		**15.72±↑16.60**		

Z: Test of Wilcoxon signed ranks
p: p-value for comparing the pre- and post-conditions.
*: Statistical significance at $p \leq 0.05$

Discussion :

This pre-post intervention study aims to evaluate the "Basic Math Practice COMBO" program’s effectiveness in rehabilitating dyscalculic Egyptian children.

The age range of the children in this study, who are of school age, is 8.0 to 14.75 years, which is comparable to the age range of the children included in Maryam et al.'s study (which was 8 to 12 years). Children engaged in **Gersten et al.** were also of academic age. [22-23]

The Stanford Binet Scale fourth version was used to measure mental age and IQ; the normal range for general IQ was 80.0 to 115.0. This was consistent with the opinions of many experts who identified cases of DD when people had normal intellectual capacity but performed poorly in math, to the point where there was a substantial gap between their math skills and IQ as **Morsanvi et al. ang Gliga et al**. [24-26]

On the other hand, dyscalculia was linked to a relatively low IQ, according to **Shalev et al.'s (2005)** research. [27]

Males made up the vast majority (76%) of individuals in the dyscalculic group in the current study. The stated

DD gender ratio in previous studies was inconsistent. According to some research, DD is equally common in young children (kindergarten through the second grade) but more common in boys than in girls in grades four and up. [28]

In contrast, some research discovered a slightly higher frequency of DD in girls than in boys, while other studies discovered a similar prevalence of DD in older primary school students of both genders. [29-30]

The overlap between dyslexia and dyscalculia is substantial. One of the most prevalent cognitive impairments linked to DD is dyslexia. In 54% of the cases examined, dyscalculia coexists with dyslexia. Similar to this, one of the studied groups in Willburger et al. had both dyslexia and dyscalculia. Additionally, Michaelson et al. found that 17% of children with dyscalculia are also dyslexic. [31-32]

Rosen P study discovered that (43-65%) of children with mathematics problems also experienced reading difficulties. While mathematical aspects that are less reliant on manipulating with verbal codes (such as estimating and subitizing) are nonetheless unaffected, those that do (such as counting speed and number fact recall) are affected by dyslexics' deficits in phonological processing. As a result, it is suggested that a thorough evaluation of dyscalculia include a test for dyslexia. [33-34]

It was believed that children with ADHD struggled to pay attention to details, which affects how well they perform in mathematical tasks that required persistent focusing to complete sequential mathematical processes. In 20% of the patients examined, dyscalculia was linked to Attention-deficit hyperactivity disorder (ADHD). According to Michaelson et al., 26% of dyscalculic children suffered from attention deficit hyperactivity disorder. [32]

This outcome was consistent with the Zentall study, which discovered that students with ADHD reported higher rates of math learning difficulties than the general population (6 to 7%), at a rate of 31%. Reassessing mathematic abilities is advised after managing ADHD symptoms. [35-36]

According to Maryam et al., teaching the number sense page improves mathematic skills in both normal and dyscalculic students, which supports the findings of this study. The Grades of students with normal and dyscalculic abilities before and after tests differed significantly (p 0.001). Number concepts in second grade students improved after intervention according to **Bryant et al**. [22, 37]

Additionally, **Gersten et al**. showed that students with dyscalculia in particular benefit much from comprehending numerals. Similarly, Cornoldi et al. found that after training, numerical knowledge increased. [23, 38]

This study found a significant difference statistically in computation before and after therapy (p 0.001) among participants in the study group, which is consistent with **Cornoldi et al**.'s findings; that post-training improvements were seen in mental calculation time and mental calculation error. In **Bryant et al.'**s post-intervention study, combinations of addition and subtraction as well as counting improved.

According to **Maryam et al**., both dyscalculic and normal pupils outperformed the control group in mathematics, which shows that the students' addition, subtraction, multiplication, and division skills significantly improved. [22, 37-38]

In the group under study, there was a significant difference statistically in math in daily life before and after therapy (p 0.001). According to **Bryant et al. (2008)**, intervention for the treatment of dyscalculia improves number concepts (counting, number recognition and writing, comparing, and grouping numbers, and numeric sequencing), reading and writing numbers, and addition and subtraction combinations, all of which result in an improvement in the students' day-to-day lives after therapy. [37]

Examined group's ability to solve word problems was evaluated pre and post therapy. The outcomes revealed a significant difference statistically between the word problems in the investigated group. (p 0.001). Data supporting our finding were presented by Swanson et al., who found that word problem solving increased following successful intervention. [22,39]

Students who have used visual stimuli have been shown to have a stronger understanding of mathematics and to be significantly more motivated to do their maths assignments. These students are more adept at applying their knowledge of math to real-world situations. Which is similar to the studied program, which heavily relies on visual exercises. [22,39]

In the group under study, a significant difference statistically found between the descriptive phrases used before and after therapy. (p 0.001). Post-training, the knowledge of descriptive terms improved, according to **Cornoldi et al**. [38]

In this study, the studied group's attitude towards mathematic improved significantly after therapy. The results of this study are in agreement with those of Omoniyi et al., who showed improvements following intervention in self-esteem, teacher-student communication, and emotional disturbance, all of which had a beneficial impact on attitudes towards math. [40]

Additionally, **Zerafa et al**.'s findings showed that effective dyscalculia treatments might significantly boost self-esteem and foster more positive attitude development regarding the mathematical learning. The children stated before the program that they didn't like mathematics, yet while training they said things like, "This is a real lot of fun, can we do this again?" and "Oh no! Is the meeting already over? Additionally, it was discovered that the children became more engaged in mathematics on their own. Every session, the children will evaluate their progress, which will help them recognize their mathematical progress. They came to the realization that, contrary to what they had previously thought, they were not total mathematical failures. [41]

According to a topic related meta-analysis, Symptom-specific interventions, in which people with dyscalculia are specifically given mathematical tasks to practice, significantly outperform no intervention or specific non-symptomatic interventions that just impart other general skills (like working memory), in terms of improving all aspects of mathematical performance. The average effect size (Hedges' g) for all intervention studies was 0.52, with a 95% confidence range between 0.42 and 0.62. This study's findings, which show improvement in scaled scores for concepts and symbols, computation, daily life mathematical issues, and solving of problems, are consistent with performance improvements of 0.30 [0.08; 0.52] across numerical and quantitative analysis, Basic mathematical operations scored 0.44 [0.14; 0.58], and word problems scored 0.47 [0.14; 0.61]. [42]

Conclusion:

More studies with larger sample size are needed to confirm the results of the present study. The study showed effectiveness of the remediation program as regards improvement of math symbols & concept, computation, math in every-day life, word problem and percentile rank. Improvement of Arabic version of TOMA3 of dyscalculia assessment post therapy.

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List of Abbreviations :

ADAT	Arabic dyslexia assessment test
ADHD	Attention Deficit Hyperactivity Disorder
ICD-10	International Classification of Diseases, tenth Revision
PR	Percentile range
DD	Developmental Dyscalculia
DLD	Delayed Language Development
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders (4th edition)
IQ	Intelligence Quotient
MLD	Mathematical Learning Disability
RD	Reading Disability
SS	Scaled score
TOMA-3	Test of Mathematical Abilities-Third Edition

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