

Proposal for an integrative psychotherapeutic program for the care of children with dyslexia

An experimental study on a sample of children in sétif Province

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Abstract:

This study aims to propose a therapeutic protocol based on an integrative psychotherapeutic approach for managing children with dyscalculia in Sétif Province. An experimental study was conducted involving twelve schoolchildren diagnosed with dyscalculia. The protocol incorporated a selection of psychotherapeutic techniques derived from eclectic psychotherapeutic approaches, synthesized according to integrative principles. The therapeutic program included behavioral, neurocognitive, and family-based psychological techniques, along with the integration of virtual reality. The intervention was implemented over three months, with two sessions per week.

Results demonstrated notable improvements in point counting, backward counting, dictation, mental calculation, and number reading skills. These findings indicate that the therapeutic program contributes significantly to alleviating mathematical difficulties among the study participants.

Keywords: Dyscalculia, Behavioral therapy, Neurocognitive therapy, Family therapy, Integrative approach.

JEL Classification Codes: I21, I19, D91, J13.

Résumé :

Cette étude vise à proposer un protocole thérapeutique basé sur une approche psychothérapeutique intégrative pour la prise en charge des enfants ayant une dyscalculie au niveau de la wilaya de Sétif. Une étude expérimentale a été réalisée sur un échantillon composé de douze écoliers diagnostiqués avec une dyscalculie. Le protocole a intégré une sélection de techniques psychothérapeutiques issues d'approches psychothérapeutiques éclectiques, synthétisées selon des principes intégratifs. Le programme thérapeutique comprenait des techniques psychologiques comportementales, neurocognitives et familiales, ainsi que l'intégration de la réalité virtuelle. L'intervention a été mise en œuvre sur trois mois, en moyenne deux séances par semaine.

Les résultats ont démontré des améliorations notables dans les compétences de comptage de points, de comptage à rebours, de dictée, de calcul mental et de lecture des nombres. Ces résultats indiquent que le programme thérapeutique contribue de manière significative à atténuer les difficultés mathématiques chez les participants à l'étude.

Mots-clés : Dyscalculie, Thérapie comportementale, Thérapie neurocognitive, Thérapie familiale, Approche intégrative.

JEL Classification Codes: I21, I19, D91, J13.

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1. Introduction:

Childhood is one of the most important stages in a person's life, as it is a period of rapid cognitive, emotional and social development. During this period, children begin to acquire the basic skills that form an important foundation for their future academic and personal development. Among the most important skills are academic competencies, especially in arithmetic, as it is a skill that relies on logical understanding and abstract thinking. However, many children face continuous difficulties in this area, which are not necessarily due to low intelligence or lack of care, but rather to specific developmental disorders.

Dyscalculia is classified as a specific learning difficulty and manifests itself as a disorder in the processing of numerical information. Desoete (2004), defined it as a long-term disorder that affects a child's ability to understand numbers and perform basic operations without mental problems or inappropriate educational conditions. It is manifested by poor comprehension of number concepts, slow counting, frequent errors in mental arithmetic, inability to memorise the results of simple operations such as addition and subtraction, and difficulty in perceiving relationships between quantities. Despite receiving a similar education to that of their peers, their academic levels in mathematics remain low, wondering about the underlying causes of these persistent failures. (Desoete, 2004, p. 67)

This has been demonstrated in recent literature, which shows that dyscalculia is not a single causal disorder but rather the result of the interaction of several neurological, cognitive, and emotional factors. Studies indicate that the disorder is associated with the dysfunction in the areas of the brain responsible for numerical processing, as well as weaknesses in working memory and attention, and the impact of anxiety associated with mathematics and the educational environment. (Butterworth & Kovas, 2013)

This multiplicity of sources of difficulty makes it difficult to diagnose the disorder and deal with it effectively in an educational setting, especially since Algerian schools, like many educational systems around the world, face real difficulties in dealing with learning difficulties, particularly those related to dyscalculia. Despite growing awareness of the importance of addressing these cases, the reality is that interventions remain limited and weak. Early detection of learning disorders is not carried out regularly or systematically and is often delayed until advanced stages, which exacerbates the problem. Individual follow-up of children with these difficulties is non-existent, either due to a lack of training among teachers or insufficient resources in schools.

Given these challenges and the difficulty of providing effective care, it has become necessary today to rely on an integrative approach to dyscalculia, as it is not only a cognitive problem, but also involves psychological, social and educational factors. Programmes that rely solely on teaching numbers or solving exercises do not address the root of the problem. Rather, several components must be integrated: cognitive, psychological, educational and even family-related.

This is confirmed by Houssaye, who states that the most successful therapeutic programmes are those that combine several approaches, including psychological and educational support with mental exercises and motivational activities, which contribute to strengthening cognitive functions such as memory and attention (Houssaye, 2014, p. 132).

Similarly, a study by Desoete and Roeyers showed that children who benefit from interventions based on a variety of treatment methods, such as mental games and strategies to strengthen attention and working memory, show a marked improvement in arithmetic performance (Desoete & Roeyers, 2005, p. 158). A study by Lazazga Hamza also supported the importance of involving the family in treatment programmes within a selective approach, proposing a model for treating children with

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learning difficulties that includes psychological and educational treatment and family participation. He concluded that the programme contributed significantly to reducing difficulties and improving school performance (Iazazqa, 2018, p. 47).

Hence, the philosophy of this programme was established through a selective integrative psychotherapeutic approach that includes analysing the content of a set of multi-oriented therapeutic techniques proven to be effective in treating dyscalculia, selecting the most effective ones, and then synthesising them according to a model to come up with a therapeutic programme. The programme is specifically designed to suit the characteristics of children with dyscalculia, through gradual therapeutic activities aimed at enhancing counting skills, quantitative discrimination, mental arithmetic, and numerical information retention, in a stimulating and interactive learning environment. The involvement of the family and the use of technology as a motivating factor for continuity and practice inside and outside the therapy sessions were also taken into account. Based on this, the research question of our study is defined as follows:

What is the role of the proposed integrative therapeutic programme in alleviating dyscalculia in a sample of primary school children?

2. Research hypotheses:

2.1. General hypothesis: The proposed integrative therapeutic programme plays an important role in alleviating dyscalculia among the children in the study sample

2.2. Procedural hypotheses:

Procedural hypothesis 1: There are statistically significant differences in the degree of counting skill before and after the application of the proposed therapeutic programme for children with dyscalculia.

Procedural Hypothesis 2: There are statistically significant differences in the level of backward counting skills before and after the implementation of the proposed therapeutic program for children with dyscalculia.

Procedural Hypothesis 3: There are statistically significant differences in the degree of number spelling skills before and after the application of the proposed therapeutic programme for children with dyscalculia.

Fourth procedural hypothesis: There are statistically significant differences in the degree of oral mental arithmetic skills before and after applying the proposed therapeutic programme for children with arithmetic difficulties.

Fifth procedural hypothesis: There are statistically significant differences in the degree of number reading skills before and after applying the proposed therapeutic programme for children with arithmetic difficulties.

3. Study objectives:

- Propose an integrated treatment programme based on neuroscience and family systems, using applications and artificial intelligence to support Algerian clinical practice in the care of people with dyscalculia.

- Design a therapeutic programme that addresses the difficulties encountered when applying the Algerian version of the ZAREKI-R battery.

- Achieve therapeutic results that contribute to the objectives of the Algerian educational curriculum.

- Improve counting, ordering and numerical comparison skills.

- Improve mental arithmetic skills.

- Improve children's performance in reading and spelling numbers.

- Develop arithmetic performance in addition and subtraction.

3- Importance of the study:

3-1- Theoretical importance:

-This study represents an important scientific addition by addressing a sensitive school problem, namely dyscalculia, from the perspective of an integrative approach in psychology. It provides a comprehensive theoretical framework that clarifies the nature of dyscalculia, its manifestations, causes, and implications for children's academic achievement and cognitive development, while also contributing to a broader theoretical understanding of the concept of dyscalculia.

The study also contributes to enriching the Arabic scientific literature on learning difficulties by localising global concepts in the Algerian school environment, with the possibility of highlighting the importance of the primary stage as the foundation for building cognitive abilities, which makes understanding dyscalculia at this stage of great theoretical importance.

3-2- Practical importance:

The study seeks to propose an integrative treatment programme for children with dyscalculia, based on a combination of psychological and educational approaches. The expected results will contribute to improving psychological and educational practices within Algerian schools and could serve as a starting point for developing effective strategies to reduce the exacerbation of arithmetic difficulties in later stages of schooling (middle and secondary) through early intervention in primary school. The study may also provide a practical tool for psychologists and teachers to help them understand the nature of the difficulties and apply effective treatment strategies.

4. Study concepts:

Integrated treatment programme: A set of scientific exercises and various organised and planned activities based on combining therapeutic approaches and selecting appropriate and integrated techniques. The current study was based on neuropsychological, family and electronic knowledge aimed at caring for children with dyscalculia aged between 8 and 11 years old, with the aim of overcoming its symptoms within a specific period of time.

Dyscalculia: is a comprehensive term used to refer to various conditions that cause specific difficulties in mathematics, such as developmental dyscalculia, numerical learning difficulties, and numerical fact disorder. It is used to refer to different levels of difficulty in mathematics, as it affects the ability to acquire mathematical skills. Learners with dyscalculia may have difficulty understanding simple number concepts, lack an intuitive understanding of numbers, and have problems in learning number facts and procedures. Even if they give the correct answer or use the correct method, they may do so mechanically and without confidence. (Jane Emerso, 2010, p01)

5- Treatment programme:

The treatment programme proposed in this study is based on the principles of integrative paradigms, which focus on integrating therapeutic approaches and selecting and applying a set of treatment programmes included in the integrated approaches to treating dyscalculia. This therapeutic programme combines cognitive neurotherapy techniques and systemic family therapy techniques with the inclusion of electronic techniques.

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5.1. General objective of the programme:

To propose an integrative therapeutic programme for children with dyscalculia.

5. 2. Specific objectives of the programme:

- Integrate and select cognitive neuroscience, systemic family therapy and electronic techniques.
- Improve working memory performance.
- Develop mathematical skills and the ability to process and understand numbers, understand instructions and verbal passages, perceive space and mathematical facts.
- Educate families of children with dyscalculia on ways to support and help their children.
- Use artificial intelligence to develop and consolidate mathematical skills.
- Provide a suitable learning environment and tangible resources.
- Enhance and stimulate the child's desire to learn mathematics through varied and enjoyable activities.
- Designing activities that are graded in terms of ease and difficulty, taking into account the child's developmental stage.
- Providing a clear, step-by-step treatment programme to help clinicians, parents and teachers work with children with dyscalculia.

5-.3- Operational Objectives:

Through the application of neurocognitive and electronic techniques:

- Counting: We develop the principles of counting, spatial awareness, counting objects, counting with fingers, representing numbers with fingers, and reading numbers represented with fingers.
- Reverse verbal counting: We develop the ability to control the verbal sequence of counting down.
- Spelling numbers: We develop the ability to write numbers when hearing them from the ones, tens, and hundreds categories.
- Verbal mental arithmetic: We acquire arithmetic facts and calculation strategies (addition and subtraction).
- Reading numbers: Developing the ability to read numbers in the ones, tens, and hundreds.
- Locating numbers on a number line: Being able to predict the approximate location of a number on a number line.
- Developing working memory skills: Retaining and recalling numbers in order or in reverse order.
- Comparing numbers: Identifying the larger and smaller numbers in a sequence, both in writing and orally.

Through the application of family systemic therapy:

- Developing family bonds with the child.
- Explaining the psychological and neurocognitive condition from which the child suffers.
- Reorganising tasks and roles within the family to provide an educational family environment for the child.
- Homework to support family accompaniment in learning
- Reinforce mathematical knowledge through experiences in the child's daily life so that they can connect what they learn in therapy sessions with reality.

6- The Content of the Therapeutic Program:

The symptoms, manifestations and causes of dyscalculia vary from case to case, so this characteristic must be taken into account when designing the treatment programme. The researcher developed the programme on a selective integrative basis so that she could use different techniques to support the various aspects of dyscalculia in children. Thus, different theoretical backgrounds were relied upon, namely: cognitive neuroscience, which enables us to understand the developmental stages of children and their cognitive and sensory development, and is considered one of the latest sciences that seeks to explain and develop learning, based on previous local and foreign studies, in addition to the systemic theory of applying family therapy and providing guidance to parents to understand and accept their child's condition and train them in ways to help and teach their child. Artificial intelligence was also relied upon through electronic games to attract the child to learn arithmetic in a fun way and to better establish mathematical concepts.

The researchers relied on a set of previous studies that included psychological treatments based on a selective approach to choose the most appropriate and effective ones and an integrative approach to reintegrate them into a unified model using the ZAREKI -AR battery to determine the targeted dimensions of the therapeutic programme. This is a diagnostic battery for people with dyscalculia, originally from Germany, which has been adapted, modified and standardised for the Algerian environment by Dr Hassane Lamia. The battery enables the concepts to be arranged and the acquisition of mathematical skills to be graded in a logical manner, starting with easy concepts and gradually moving on to difficult ones. The impact of this programme can then be assessed by reapplying the battery. The sub-tests consist of basic skills that enable the acquisition of arithmetic, through which we can identify the child's weaknesses and the causes of their dyscalculia, and thus resolve them. Here, we can come up with a precise scientific analysis and interpretation that proves the difference in symptoms and causes and, consequently, the difference in the methods used with each child to achieve an effective impact on their level.

The design of the therapeutic programme was tailored to the age group of the sample, which ranged from 8 to 11 years old. To achieve the programme's objectives, it was divided as follows:

Therapeutic Orientation	Techniques Used	Number of Sessions	Session Duration (minutes)
Cognitive-Neurological	Memory retention and retrieval	3	45
	Working memory activation	3	50
	Mental calculation	4	30
	Comparison between greater and smaller	1	30
	Spatial perception	1	40
Systemic-Family	Psychoeducation	2	30
	Distribution of tasks and roles	2	30
	Family accompaniment/support	2	45
	Family empathy and acceptance	1	30
	Electronic games	3	45
Electronic	Video clips	1	30

Table No. 1: Shows the content of the treatment program

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7-Field study:

7-1- Study methodology:

The researchers adopted a quasi-experimental methodology based on a single group with pre- and post-measurements, where the independent variable was the proposed therapeutic programme and the dependent variable was dyscalculia, taking into account the quantitative and qualitative similarity and proportional homogeneity of the sample individuals under study. This was followed by a comparison of the dyscalculia scores obtained before and after the application of the proposed integrative therapeutic programme in order to determine the effectiveness of the proposed therapeutic programme proposed therapeutic programme in caring for children with dyscalculia.

7-2- Spatial and temporal framework of the study:

This study was conducted at the level of the screening and psychological follow-up units of the Mental and Psychological Health Service for Children and Adolescents in Setif, where the study period extended from 2024 to 2025.

7-3- Study sample:

The study group consisted of 12 children, including 7 males and 5 females, enrolled in primary school, aged between 8 and 11 years old, with dyscalculia.

7-4- Study tools:

A set of tools was used to carry out and implement this study, as follows:

7-4-1- Observation: This is a tool for collecting qualitative data that cannot be measured scientifically and systematically. It is a means of raising questions and testing hypotheses or even verifying their validity. It involves carefully observing a phenomenon and recording it for interpretation on a scientific basis. (Ciconne, 2014, p07)

7-4-2-Interview: An interview is an interaction, primarily verbal, between two people with a predetermined goal. The types of interviews vary according to the fields of application, objectives, or even the methods used. For example, an interview may aim to obtain information, to help or guide others, to care for or support someone, such as a therapeutic interview. (Izard, 2010, p. 2) It should be noted that the researchers designed a semi-structured interview guide for parents with the aim of collecting data on the situation.

7-4-3-WISC-4 Intelligence Test: the Wechsler Intelligence Scale for Children (WISC-IV), developed by David Wechsler in 2003, is a test for children aged 6 years and 0 months to 16 years and 11 months, designed to assess general intelligence and various cognitive abilities and to diagnose mental retardation or giftedness. The scale consists of 15 subtests, including verbal and performance scales, and measures multiple aspects such as perceptual reasoning, verbal reasoning, working memory, and processing speed, which are combined to obtain an overall intelligence score. The test is administered in a quiet environment and the session lasts approximately 90 minutes. The examiner relies on specialised tools such as a user manual, stimulus booklets, symbols, cubes and correction grids, with the possibility of compensating for some subtests if the child is unable to perform them (Wechsler, 2003.P29).

7-4-4-ZAREKI-R-A Algerian version: An assessment and treatment battery for arithmetic and calculation, translated, modified and adapted to the Algerian environment by Hassane Lamia

(2011), who studied and tested it and extracted its specific criteria for Algerian children. The battery aims to clinically detect each child's specific difficulties in arithmetic in order to develop an individualised educational plan based on the strengths and weaknesses revealed by the assessment results. The test originates from the German version developed by Von Aster (2001) under the name Neuropsychologische Testbatterie für Zahlenverarbeitung und Rechnen bei Kindern, which was then translated and adapted by George Dellatolas (2006) into French under the name ZAREKI-R Batterie pour l'évaluation du traitement des nombres et du calcul chez l'enfant, and published by Les Editions du Centre de Psychologie Appliquée, before being adapted to the Algerian environment to become the ZAREKI-R-A version. The battery contains a set of tools: a stimulus booklet, a scoring booklet, a user manual, a scoring grid, and an answer booklet. (Hassan, 2011, pp. 291–293)

The battery allows for the assessment of: knowledge of number sequences, counting ability, number representation, knowledge of numerical facts, knowledge and application of operational procedures, ability to estimate and compare numbers and quantities, understanding of the meaning of numbers, and working memory. (Simon, 2014, pp. 33–34)

8- Presentation and discussion of study results:

8-1- Data exploration process:

The first step before performing statistical analysis of the scale items is to explore the data and determine which measurement level the obtained data falls under. Given the importance of this process, we will:

First: Identify the distribution of the data (normal distribution, Poisson distribution, etc.).

Second: Identify how the data is distributed (randomly or according to a specific pattern).

First: Moderation of distribution: (Shapiro-Wilk, Kolmogorov-Smirnov)

Table No. (2): Shows the value of the Kolmogorov test to detect the normality of the distribution.

Dime nsions	Sha piro-Wilk Statistic	Sha piro-Wilk df	Sha piro-Wilk Sig.	Kolmo gorov- Smirnov Statistic	Kolmo gorov- Smirnov df	Kolmo gorov- Smirnov Sig.
Pre- test	,33 5	11	,00 1	,786	11	,006
Post- test	,44 8	11	,00 0	,572	11	,000

Table 2 shows that Shapiro-Wilk statistics were not statistically significant for all study variables, while Kolmogorov-Smirnov statistics were statistically significant. Therefore, it can be said that the data distribution is moderate, and thus we follow non-parametric statistics.

8-2- Presentation and analysis of hypothesis results:

8-2-1- General hypothesis: The proposed integrative treatment programme plays an important role in alleviating dyscalculia in children with dyscalculia.

Variable	N	Mean Rank	Sum of Ranks
Program (Negative Ranks)	0	.00	.00
Program (Positive Ranks)	12	6.50	78.00
Ties	0		
Total	12		

Table (3) presents the descriptive statistics of the Wilcoxon test for the general hypothesis.

From **Table (3)**, it appears that the negative ranks have a mean rank of **.00**, whereas the positive ranks have a mean rank of **6.50**, This indicates that the differences are in favor of the **positive ranks**.

Values	Post-test – Pre-test
Z value	-3.062
Asymptotic Significance (2-tailed)	.002
Effect Size	.873

Table (4) represents the statistical significance of the Wilcoxon test for the general hypothesis. From **Table (4)**, it appears that the Z-value of the Wilcoxon test reached **-3.062**, while its statistical significance was **.002**, which is a value lower than the accepted significance level of **0.05**. Therefore, it can be concluded that: **the proposed integrative remedial program plays an important role in reducing dyscalculia among children with mathematical learning difficulties, with a very high effect size exceeding 0.60 according to Cohen's criterion.**

This result is consistent with the findings of a study by Kroesbergen, E., & Van Luit, J. E. H. (2003) entitled Treatment of Mathematics Difficulties in People with Special Needs, which concluded that therapeutic programmes designed to treat mathematics difficulties, if they include multiple performative, recreational, behavioural and educational activities, lead to a significant reduction in the severity of dyscalculia. (Kroesbergen et al: 2003, P: 97)

The results of the general hypothesis Ise, E., Dolle, K., Pixner, S., & Schulte-Körne, G. (2012) entitled Effective Interventions for Children with Dyscalculia: A Twin Analysis of Learning and Its Disorders, in which the researchers reviewed previous studies in the field of dyscalculia treatment and found that a multi-faceted approach to treating dyscalculia yields more effective results than relying on single approaches. (Ise, et al: 2012. P: 181)

8-2-2. The first procedural hypothesis states that there are statistically significant differences in the degree of counting skills before and after the application of the proposed therapeutic programme for children with mathematical difficulties.

Variable	N	Mean Rank	Sum of Ranks
Dot Counting Skill (Negative Ranks)	0	.00	.00
Dot Counting Skill (Positive Ranks)	5	3.00	15.00
Ties	6		
Total	12		

Table 5 shows the descriptive statistics for the Wilcoxon test for the first hypothesis.

Table 5 shows that the negative ranks have a median rank of 0.00, while the positive ranks have a median rank of 3.00, which means that the differences favour the positive ranks.

Values	Post-test – Pre-test
Z value	-2.041
Asymptotic Significance (2-tailed)	.041

Table 6 shows the statistical significance of the Wilcoxon test for the first hypothesis.

Table 6 shows that the Wilcoxon test value was -2.041, while its statistical significance was 0.041, which is lower than the applicable significance level of 0.05. Therefore, it can be concluded that there are statistically significant differences in the degree of counting skills before and after the application of the proposed therapeutic programme for children with dyscalculia.

The results of the first hypothesis are consistent with the study by K. Kucian et al. in 2011, entitled Mental Number Line Training for Children with Developmental Maths Difficulties, which concluded that therapeutic programmes focusing on improving the spatial representation of numbers provide effective therapeutic results in raising the level of number perception, facilitating the processing of numerical tasks, and clearly increasing mental ability in children with maths difficulties. (K. Kucian et al: 2011, p: 782)

8-2-3. Second procedural hypothesis: There are statistically significant differences in the level of backward counting skills before and after the implementation of the proposed therapeutic program for children with mathematical difficulties.

Variable	N	Mean Rank	Sum of Ranks
Backward Counting Skill (Negative Ranks)	0	.00	.00
Backward Counting Skill (Positive Ranks)	12	6.50	78.00
Ties	0		
Total	12		

Table 7 shows the descriptive statistics for the Wilcoxon test for the second hypothesis.

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Table 7 shows that the negative ranks have a median rank of 0.00, while the positive ranks have a median rank of 6.50, which means that the differences favour the positive ranks.

Values	Post-test – Pre-test
Z value	-3.140
Asymptotic Significance (2-tailed)	.002

Table 8 shows the statistical significance of the Wilcoxon test for the second hypothesis.

Table 8 shows that the Wilcoxon test value was -3.140, while its statistical significance was 0.002, which is lower than the applicable significance level of 0.05. Therefore, it can be concluded that there are statistically significant differences in the degree of descending counting skills before and after the application of the proposed therapeutic programme for children with dyscalculia.

The results of the second hypothesis are consistent with the 2006 study by Wilson et al., which proposed treating dyscalculia through an electronic game involving number racing and ordering. A pilot programme was implemented on a sample of nine children aged between seven and nine who had difficulties with mathematics. The programme included half an hour of numerical comparison training per day, four days a week, and the children underwent pre- and post-tests to assess their performance in basic numerical tasks such as counting, coding, understanding decimals, and symbolic and non-symbolic numerical comparison. The children showed significant improvement in their performance on basic number tasks, as well as improvement in the speed of spelling numbers and comparing tens and hundreds. (Wilson, 2006, P: 01)

8-2-4. Third procedural hypothesis: There are statistically significant differences in the degree of spelling skill before and after the application of the proposed therapeutic programme for children with mathematical difficulties.

Category	N (Sample Size)	Mean Rank	Sum of Ranks
Negative Ranks	0	.00	.00
Positive Ranks	12	6.50	78.00
Ties	0		
Total	12		

Table 9 shows the descriptive statistics for the Wilcoxon test for the third hypothesis.

Table 9 shows that the negative ranks had a median rank of 0.00, while the positive ranks had a median rank of 6.50, which means that the differences favour the positive ranks.

Statistic	Post-test – Pre-test
Z-value	-3.065
Asymptotic Significance (2-tailed)	.002

Table 10 shows the statistical significance of the Wilcoxon test for the third hypothesis.

Table 10 shows that the t-value for the Wilcoxon test was -3.065, while its statistical significance was 0.002, which is lower than the applicable significance level of 0.05. Therefore, it can be concluded that there are statistically significant differences in the degree of spelling skills before and after the application of the proposed therapeutic programme for children with dyscalculia.

The results of the third hypothesis corresponded with the results of Zuhair Omrani's 2010 study, which analysed the cognitive nature of dyscalculia and concluded that the cause of dyscalculia is not an inevitable necessity resulting from organic deficiencies in the neural areas responsible for performing mathematical operations in the mind. but rather a special cognitive condition resulting from a deficiency in higher metacognitive skills, manifested in a malfunction in the components of the information processing system in working memory. Therefore, when we increase the ability to remember numerical forms through dictation and raise the level of memory, the child's level of arithmetic skill improves. (Omrani, 2010, p. 34)

The results of the third hypothesis also matched the study by Cecilia Robson and Anne Feters, 2016, who studied the correlation and performance characteristics in reading, spelling, and solving mathematical problems, and concluded that there is a correlation between poor spelling and difficulty in understanding and solving mathematical problems. The poorer the student's performance in spelling and spelling skills, the more difficult the calculation, and vice versa. (Cécilia & Anne 2016, p. 01).

8-2-5. Fourth procedural hypothesis: There are statistically significant differences in the level of oral mental arithmetic skills before and after the implementation of the proposed therapeutic programme for children with mathematical difficulties.

Category	N (Sample Size)	Mean Rank	Sum of Ranks
Negative Ranks	0	.00	.00
Positive Ranks	12	6.50	78.00
Ties	0		
Total	12		

Table 11 shows the descriptive statistics for the Wilcoxon test for the fourth hypothesis.

Table 11 shows that the negative ranks had a median rank of 0.00, while the positive ranks had a median rank of 6.50, which means that the differences favour the positive ranks.

Statistic	Post-test – Pre-test
Z-value	-3.062
Asymptotic Significance (2-tailed)	.002

Table 12 shows the statistical significance of the Wilcoxon test for the fourth hypothesis.

Table 12 shows that the Wilcoxon test value was -3.062, while its statistical significance was 0.002, which is less than the applicable significance level of 0.05. Therefore, it can be concluded that there are statistically significant differences in the level of mental arithmetic skills before and after the implementation of the proposed therapeutic programme for children with mathematical difficulties.

The results of the fourth hypothesis are consistent with the 2011 study by K. Kucian et al. entitled Mental Number Line Training for Children with Developmental Dyscalculia, in the section on mental arithmetic and its relationship to the level of number perception. The study proved that therapeutic programmes that include units specifically designed to raise the level of mental arithmetic clearly contribute to alleviating dyscalculia. (. Kucian et al: 2011, p: 78)

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The results of the fourth hypothesis also matched those of a study by Qasi Salima, 2014, entitled ‘Assessment of mental arithmetic skills and their role in controlling mathematical problem solving,’ which concluded that children with weak mental arithmetic skills exhibit mathematical problems in numbers and arithmetic and obtain low scores on mental arithmetic skill tests. (Qasi, 2014, p. 04)

8-2-6. Fifth procedural hypothesis: There are statistically significant differences in the degree of number reading skills before and after the application of the proposed therapeutic programme for children with mathematical difficulties.

Category	N (Sample Size)	Mean Rank	Sum of Ranks
Negative Ranks	0	.00	.00
Positive Ranks	12	6.50	78.00
Ties	0		
Total	12		

Table 13 shows the descriptive statistics for the Wilcoxon test for hypothesis 5.

Table 13 shows that the negative ranks have a mean rank of 0.00, while the positive ranks have a mean rank of 6.50, which means that the differences favour the positive ranks.

Statistic	Post-test – Pre-test
Z-value	-3.071
Asymptotic Significance	.002

Table 14 shows the statistical significance of the Wilcoxon test for the fifth hypothesis.

Table 14 shows that the Wilcoxon test value was -3.071, while its statistical significance was 0.002, which is lower than the applicable significance level of 0.05. Therefore, it can be concluded that there are statistically significant differences in the reading skills of children with dyscalculia before and after the application of the proposed therapeutic programme.

The results of the fifth hypothesis are consistent with the results of studies by Von Aster, M.G. & Shalev, R.S. in 2017, which studied the nature of number development and its relationship to developmental dyscalculia. They concluded that the ability to represent and process numerical quantities verbally requires basic cognitive and linguistic abilities, and that children with dyscalculia have language problems such as language delay and dyslexia. It is important to treat these disorders in order to improve numeracy skills. (Von Aster, M.G. and Shalev, R.S, 2017.P01)

9-Conclusion:

This study was developed with the overall objective of proposing a treatment programme based on an integrative approach to psychotherapy for children with dyscalculia, through an experimental study on a sample of children in the province of Setif. To verify the effectiveness of the programme, five procedural hypotheses were proposed, derived from five basic dimensions that constitute the fundamental aspects of arithmetic skills, represented by counting, counting down, spelling, mental arithmetic and reading preparation. The results proved that the therapeutic programme plays an important role in alleviating dyscalculia in the children in the study sample, as the therapeutic programme units contributed to raising the level of spatial perception and visual discrimination of points, which had a positive effect on the children's counting skills, which is fundamental to the perception of numbers and the discrimination of mathematical shapes and symbols, without which it is impossible to understand numerical shapes, leading to difficulty and dyscalculia.

The proposed therapeutic programme also made it possible to raise the level of counting down, thanks to its therapeutic units that raised the level of cognitive processes related to the perception of larger and smaller numbers, as well as the logical sequence of preparation, which is a characteristic that children need in order to understand the logic of addition and subtraction and the ordering of numbers so that they can perform arithmetic operations correctly. In the context of mental arithmetic and understanding the logic of the relationship between numbers and operations, the therapeutic programme contributed to modifying simple and complex mental operations in an effective manner, raising the level of mental arithmetic, whether in terms of memory and recall, or expressing correct answers and naming and recalling numbers and operations in a correct manner. This was evident in the skill of reading numbers, which increased significantly after the application of the therapeutic programme, with an improvement observed in the children in the study sample. After implementing the therapeutic programme, the children in the study sample showed improvement in their ability to spell and pronounce numbers correctly, with improved pronunciation of letters and syllables. This boosted the children's self-confidence and helped them overcome the feelings of fear that are fundamental to the emergence of anxiety and the inability to pronounce numbers. The therapeutic programme thus contributed to improving the children's number reading skills.

Based on the above, it can be concluded that the general hypothesis that the proposed integrative therapeutic programme plays an important role in alleviating dyscalculia in the children in the study sample has been confirmed, with the five procedural hypotheses related to counting skills, counting down, spelling numbers, mental arithmetic, and reading numbers.

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