International Journal of Humanities and Social Science Invention (IJHSSI)
ISSN (Online): 2319 – 7722, ISSN (Print): 2319 – 7714
www.ijhssi.org ||Volume 10 Issue 10 Ser. I ||October, 2021 || PP.63-67

Innovative Learning Strategies for Minimising Visual Spatial Difficulties Of Upper Primary School Students With Symptoms Of Dyscalculia: An Experimental Study

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Date of Submission: 18-10-2021 Date of acceptance: 02-11-2021

I. INTRODUCTION

Dyscalculia is a specific learning disability which affects one's ability to work with numbers. Students who are suffering with dyscalculia have very difficult time with the subject maths. They can't achieve good scores for mathematic even when they score comparatively good marks for other subjects. Students with dyscalculia have average or above average level of intelligence. The problem for learning exists even after working hard. As their peers they also work hard to learn mathematics and fails frequently. The critical situation occurs when they face parents' and teachers' negative attitude towards them without understanding the learning disability they are suffering. Punishments, mental torturing from the part of teachers and parents become a burden for them. Gradually they began to under estimate themselves, lose self esteem and judge themselves as worthless, useless etc. They become weak in other subjects also.

Students with dyscalculia have no serious problems with their daily life. They are able to handle their own routines like all other peers. These students have difficulties in processing mathematical concepts. This problem is closely related to brain. This is a neurological disorder of which actual cause is not identified yet. Environmental, hereditary, problems while the time of birth or pregnancy etc is assumed to be some causes for learning disabilities.

Symptoms of dyscalculia are

1. Difficulty in spatial relationship (up, down, high, low, far, near)
2. Problems in understanding place value
3. Problems in telling time
4. Difficulty with fundamental arithmetic operations (addition, subtraction, multiplication and division)
5. Difficulty with direction
6. Problems with mental math
7. Reads or/and writes number and number patterns inconsistently(writes31 as 13, 6 as 9, reverses 3's, 5's, 7's etc)
8. Difficulty with story problems
9. Cannot follow sequences in multi step problems
10. Slowness in give answers to math questions
11. Limited strategic planning skills
12. Difficulty with estimation and approximation
13. Difficulty with visualising patterns
14. Problems in grasping and remembering math concepts
15. Poor memory for identifying numbers in a clock
16. Count on figures, uses tally marks
17. They read digit wise (234 as two three four)
18. Omitting zero (zeros) of a number
19. Solves problem from left to right
20. Problems in recognising cardinality of number by visual clustering
21. Even if they know fundamental operation, unable to use in a real situation

Visual spatial difficulties of students with dyscalculia

Visual-spatial ability is the ability to mentally manipulate 2-dimensional and 3-dimensional figures. Students with dyscalculia may not use visual images effectively and find reasoning that depends on spatial

reasoning difficult to understand. Mental manipulation of images may be difficult for the pupil with dyscalculia. For learning mathematics a good level visual spatial abilities is required

The visual spatial difficulties are

1. Has difficulty copying shapes or problems
2. Has difficulty writing across paper in a straight line
3. Has confusion about before- after concepts (e.g. has difficulty with time or counting)
4. Number reversal, number transposing, and confusion in multi digit numbers.
5. Has difficulty relating to directional aspects of arithmetic, which can be noted in problems with computations involving up- down (e.g. addition), left- right(regrouping),and aligning numbers
6. Puts decimals in the wrong place
7. Has difficulty spacing manipulative into patterns or sets
8. Has difficulty using the number line
9. Has confusion about positive and negative numbers (directional)

Students with dyscalculia have disabilities in learning mathematics. A student with visual spatial difficulties faces problems in reading normal sized texts, identifying the real shape of figures etc. Worksheet should be enabled to cater the needs of a student who has visual spatial difficulties. Worksheet is a specially prepared page of exercises designed to improve one's knowledge. While preparing worksheets some characteristics are specially noticed. Learning strategies should incorporate various possibilities for enhancing visual spatial abilities. Visual presentations should be large enough, 3 dimensional videos, colouring exercises using different colours, hands on activities using geometric shapes, using graph papers etc.

Giulia et al. (2016) made a comparative study on visual spatial abilities with reading skill. The comparison was made between students with developmental dyslexia and normal readers. Study results revealed that for better understanding of the reading problems a comprehensive description and a multi- componential evaluation of visual spatial abilities is needed for children with developmental dyslexia.

NEED AND SIGNIFICANCE OF THE STUDY

The whole world is developing in each and every moment. The development reflects in education field also. In education more and more new areas are exploring in these days. Learning disability and specific learning disabilities are became known to educationalists in recent decades. A student with specific learning disability will be a gift for future if his destabilise are identified and intervened at proper time. Thomas Alva Edison. Winston Churchill, Walt Disney like eminent personalities were victims of specific learning disabilities. They were able to overcome their disabilities and became history. Like this the children with learning disability should be uplifted to the normal society. If effective intervention is done to these children they will definitely write another history.

There is an Indian film (Taare Zameen Par) released in 2007 in which the central character was an 8 year old boy (actor: Darsheel Safary) with specific learning disability, dyslexia. He was excellent in art work like drawing and colouring, but his poor academic performance forced the parents to send him to a boarding school. The academic and familial pressures, he had to face was, very clearly visualised in that film. It is very interesting that remedial strategies also visualised clearly in the film. The intervention programme given by an art teacher (actor& director: Aamir Khan) using a long time period was visualised in that film. The film expresses the emotional and social importance of the condition of specific learning disability.

In schools of Kerala there is no special care is given to identification and intervention for students with dyscalculia. A student achieving very low marks in Mathematics is considered to be lazy or irresponsible. Learning disabled students should be intervened. It will show wonders in the life of that child. Sometimes learning difficulty and learning disability are misinterpreted. Here investigator felt need for doing something for students with dyscalculia.

OBJECTIVES

1. To develop some innovative learning strategies for minimising visual spatial difficulties of students with symptoms of dyscalculia
2. To find the effectiveness of innovative learning strategies for minimising visual spatial difficulties of students with symptoms of dyscalculia

HYPOTHESIS

The developed innovative learning strategies are effective in minimising visual spatial difficulties of students with symptoms of dyscalculia.

II. METHODOLOGY

Method used: Experimental study was conducted to find out the effectiveness of developed innovative learning strategies for minimising visual spatial difficulties of students with symptoms of dyscalculia.

Sample: Sample for the study was 27 students identified with symptoms of dyscalculia studying in upper primary schools following Kerala state syllabus. Among 27 students 8 were girls and 19 were boys studying in 6^{th} and 7^{th} standards.

Tools, materials and techniques used

1. Test of visual spatial difficulties

A test constructed by the investigator to assess the visual spatial difficulties was used as pre test and post test for the study.

Construction of the items was based on the symptoms following visual spatial difficulties. There were 10 items in test. Each item possesses 1 mark. Increase in marks shows decrease in visual spatial difficulties.

2. Innovative Learning Strategies

Innovative learning strategies include various learning activities incorporating different strategies for basic Mathematics concepts. The strategies incorporated for making innovative learning strategies are

Story telling (especially for introducing new concept)
Think aloud strategy
Memory exercises
Games
Merit chart (stars for achievements)
Ear- eyes- finger coordinated activities
Kinaesthetic activities
Parent teacher interaction
Peer teaching
Showing videos, audios, pictures, related to concepts
Worksheets (colourful, large size, space for colouring)

Statistical techniques used

1. Mean
2. Standard deviation
3. Paired t test

PROCEDURE FOR THE EXPERIMENTATION

After getting the permission from the head of the school the investigator conducted the experimental study. Students with symptoms of dyscalculia were identified with the help of mathematics teachers. The selected students were informed to gather in the smart classroom with the permission of their parents. As the first step pre test was administered. From the next day, daily 30 minutes for 30 working days, the experiment was conducted. Innovative learning strategies were used as the treatment for students. After the intervention the post test was conducted. Pre test and post test scores were analysed using appropriate statistical techniques.

ANALYSIS AND INTERPRETATION OF DATA

After the collection of data the analysis is done using appropriate statistical techniques. The effectiveness of innovative learning strategies are tested by using paired t- test.

To find the effectiveness of Innovative Learning Strategies in minimising Visual-Spatial Difficulties

Null hypothesis: There is no significant difference between the mean scores of pre-test and post- test scores of students with symptoms of Dyscalculia

Research hypothesis: The developed Innovative Learning Strategies are effective in minimising Visual Spatial difficulties of students with symptoms of Dyscalculia.

Descriptive Statistics

The detail of descriptive statistics is given in the given table. Scores mean and standard deviation of pre-test and post-test are given

Test	Number of participants	Mean	Standard deviation
Pre test	27	3.48	1.27
Post test	27	6.56	1.55

Table 1: Descriptive statistics

From the table it can be observed that the mean score of pre-test is 3.48 and standard deviation is 1.27; mean score of post-test is 6.56 and standard deviation is 1.55. Whether there exists a significant difference, it will be revealed through appropriate inferential statistics analysis. Diagrammatic representation is given below.

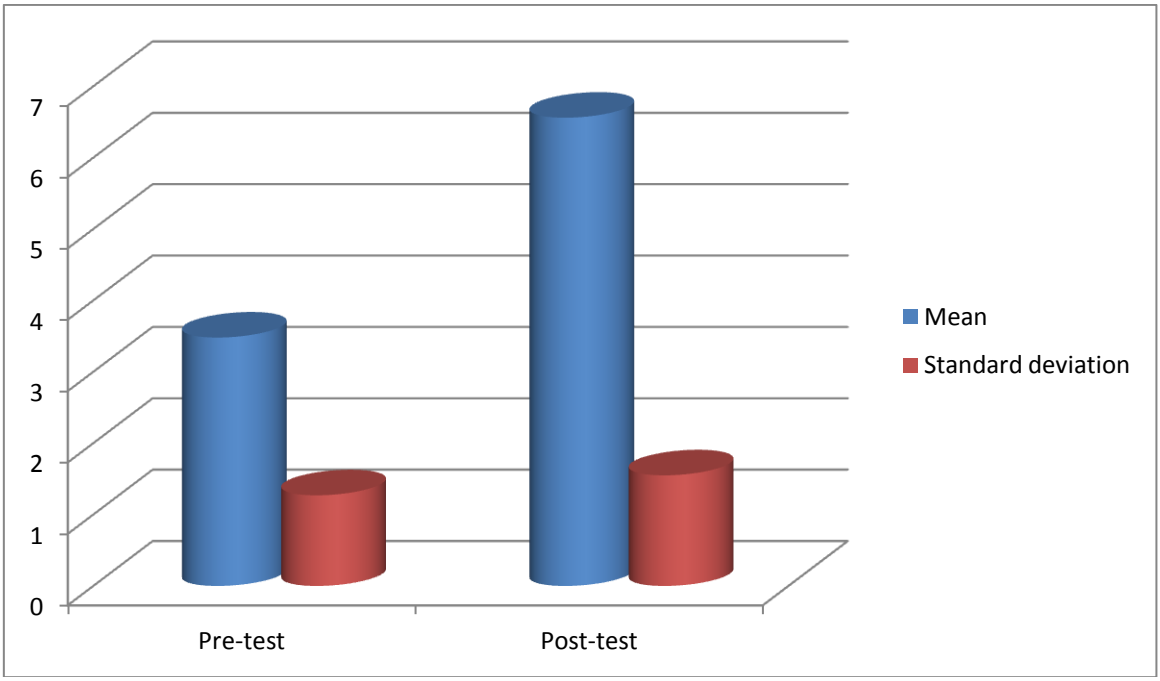

Diagram : Descriptive statistics

Paired t-test is conducted to test the hypothesis. Mean scores of pre-test and post-test are compared using paired t-test. The below table represents the details related to the paired t-test conducted.

Test	Mean	SD	N	Degrees of freedom	t- value
Pre-test	3.48	1.27	27	26	9.03
Post-test	6.56	1.55	27		

Significant at 0.01 level

Table 2: Comparison of mean scores using t- test

Calculated t-value is 9.03 and the table value is 1.315. Here calculated t- value is greater than table value, so the null hypothesis is rejected. So there exists significant difference between pre-test and post-test mean scores. Thus developed innovative learning strategies are effective for minimising visual spatial difficulties of students with symptoms of dyscalculia.

FINDINGS BASED ON THE ANALYSIS

Developed innovative learning strategies for minimising visual spatial difficulties of students with dyscalculia are effective. The statistical testing revealed that the pre-test and post test mean scores differ significantly.

III. DISCUSSION

Innovative learning strategies were proved to be effective for minimising visual spatial difficulties of students with dyscalculia. It was a new experience for the students. The worksheets were of 18 font size which was larger than normally used font size. So the students became capable to read without strain. Without regular difficulties they were able to work on the learning sessions. There were pictures to colour on it. They were very interesting in doing that. The innovative learning strategies proved to be effective for minimising visual spatial difficulties. There were various studies which proved to be various interventions effective for students with dyscalculia.(Nagavalli, 2015; Syah et al,2015& Zefara, 2015;).

IMPLICATIONS

1. The study emphasises the importance of intervention for students who need special care.
2. Worksheets can be used to make lessons interesting for normal students too. So teachers should incorporate worksheets in daily classroom learning.
3. Learning disability can't be cured but it can be reduced to low intensity by continuous practicing. Teachers should work for that.
4. Inclusive education gives little importance to learning disabled students; identification and intervention are not progressing. Training should be given to all teachers in this field.
5. It is clear that intervention will improve the abilities of students with specific learning disabilities; majority of students don't need scribe for examinations, what they need is only timely intervention and consideration.

IV. CONCLUSION

Learning disability is not an illness. It is a condition occurred because of neurological dysfunction. From the present study it got a clear picture that difficulties of students with symptoms of dyscalculia can be minimised by using appropriate strategies for a continuous period of time. More innovative interventions should happen for the good of our universe, since various great personalities had experienced learning disabilities in their childhood. No children should be left behind because of any disability.

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