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Brief Report

Impact of various Instructional Strategies for Enhancing Mathematical Skills of Learning Disabled Children

Taranjit Kaur, PhD, Tehal Kohli, PhD, Batani Devi, PhD
Address for Correspondence: Professor Tehal Kohli, Chairperson (Retd.) & Emritus Fellow (UGC) Department of Education, Punjab University, Chandigarh.

ABSTRACT
Aim: The current study tested the comparative efficacy of various strategies on basic mathematical skills of learning disabled children. **Methods:** Learning disabled children were randomly assigned to multimedia, cognitive, eclectic and control conditions. Assessment included the use of IQ, Diagnostic Test of Learning Disability, and Pre and post-test administration of the Children with Specific Learning Disabilities in Arithmetic scale. **Results**: All the tested strategies significantly enhanced basic mathematical skills of learning disabled children. **Conclusions:** Multimedia, cognitive strategy and eclectic approach can be used for enhancing the mathematical skills of learning disabled children.
Keywords: Learning disability, Mathematical skills, Instructional strategies

INTRODUCTION
Individuals with learning disabilities have normal intelligence but experience problems in academic areas such as reading, writing and mathematics. The concept of learning disabilities focuses on the notion of a discrepancy between a child's academic achievement and his/her apparent capacity to learn. The problems may be due to cerebral dysfunctions or emotional or behavioural disturbances but not due to mental retardation, sensory deprivation or cultural or instructional practices.

Learning disabilities in arithmetic have traditionally received less attention than other academic areas. An upsurge in research and the development of numerous tests and materials for arithmetic disabilities occurred during the 1970's.[1] Students with learning disabilities in arithmetic can be found in all age and grade levels. During preschool and early primary grades these children have difficulty in matching or sorting activities, counting and differentiating various sizes. During the elementary grades students with difficulty in arithmetic often encounter problems with computational skills, as well as with measurements, decimals, fractions, percentages and problem solving.

Evidence indicates that large number of learning-disabled students requires remedial assistance in mathematics.[2] Authors have reported significant improvements in the skills of the learning disabled children with the help of multimedia;[3-5] cognitive strategies,[6,7] and eclectic approach.[8,9]

METHOD
Children and Setting: 40 third standard students from public and convent schools in Chandigarh were selected for the study, based on the following criteria: a score of ≥90 on Wechsler Intelligence Scale for Children (Primary) by Malin;[10] confirmed learning

disability in mathematics based on Diagnostic Test for Learning Disability;[11] and Assessment of Children with Specific Learning Disabilities in Arithmetic.[12]

Design: Ten subjects were randomly assigned to four groups: three treatment groups (multimedia, cognitive strategy and eclectic approach) and one control group. Treatments strategies were randomly assigned to the three treatment groups. All the four groups were assessed before and after treatment on Assessment of Children with Specific Learning Disabilities in Arithmetic[12].

Intervention Procedure: Pre-intervention application of a homogeneity test showed that the four groups were homogenous. Each child of the three experimental groups was provided intervention by the trainer on alternate days i.e. thrice a week for 40 minutes. The experimental group 1 (EG_1) received intervention with multimedia. Clear, illustrative and colourful graphical lessons were prepared and presented with the help of a computer. Children were given lesson plans for each concept and exercises to master that concept. Recapitulation sessions of 15 minutes were held to clear doubts. A cognitive strategy was implemented for the experimental group 2 (EG_2). A step-wise worksheet for each problem was prepared based on the needs of the child. Examples were taken from their every day experience to help them understand the targeted concepts. Children graduated to the next skill only after they had mastered the earlier one. An eclectic approach i.e. combination of both multimedia and cognitive strategy was employed for the experimental group 3 ($EG_{3)}$. Strategy selection was based on the nature and severity of the child's problems.

The t-test was employed on dependent means obtained from the scores on Assessment of the Children with Specific Learning Disabilities in Arithmetic Test to test the effectiveness of three remedial strategies.

RESULTS

All the three strategies i.e. multimedia, cognitive strategy and eclectic approach produced significant enhancement in mathematical skills at the post-test assessment for readiness, number concept, computation, problem solving and total achievement scores (Table 1). There was no improvement in the test scores in the control group. Also, all the three strategies produced significantly greater enhancement in mathematical skills as compared to the control group (Table 2).

DISCUSSION

These results support the findings of various authors, who have reported on the efficacy of multimedia;[3,13] cognitive strategies;[6,7,14,15] and eclectic approach;[8,9] in enhancing the mathematical achievement or performance of learning disabled children. The study shows that special educationists and regular teaching staff can utilize these strategies for providing remedial measures.

The results support the possibility that imparting remedial education at early age may reap high benefits. There is a need for a well defined policy by the government authorities to cater to issue of learning disability in mathematical skills. However, more systematic work needs to be done in the field of educational multimedia to maximize the potential output from this medium.

TABLE 1: Mean Differentials between Pre-and Post-Test Scores in Various Mathematical Skills of Control Group, Experimental Group 1, Experimental Group 2 and Experimental Group 3

Skills	M_1	M_2	SD_1	SD_2	t-value	Significance
Control Group						
Readiness	55.30	55.60	5.29	4.38	0.580	N.S
Number concept	11.00	11.30	1.94	1.25	0.669	N.S
Computational	17.30	19.30	6.06	5.89	1.762	N.S
Problem solving	0.60	1.00	1.07	1.05	1.768	N.S
Total Achievement	84.20	87.20	9.03	6.65	1.357	N.S
Experimental Group 1						
Readiness	53.90	59.20	5.78	2.78	3.999	.01
Number concept	9.80	15.20	2.30	1.75	8.491	.01
Computational	20.60	32.60	8.34	3.98	6.639	.01
Problem solving	1.10	4.50	1.10	1.35	7.965	.01
Total Achievement	85.40	111.50	13.1	5.84	8.381	.01
Experimental Group 2						
Readiness	58.20	62.40	5.09	2.37	3.674	.01
Number concept	11.20	16.40	1.03	1.43	10.614	.01
Computational	19.20	31.20	6.92	2.35	6.156	.01
Problem solving	0.30	4.30	0.95	2.11	5.367	.01
Total Achievement	88.90	114.30	9.84	5.87	9.224	.01
Experimental Group 3						
Readiness	57.50	63.40	3.78	2.22	6.075	.01
Number concept	9.60	16.60	1.07	1.07	21.000	.01
Computational	19.80	37.80	5.92	1.03	9.288	.01
Problem solving	0.70	5.20	1.06	1.14	10.510	.01
Total Achievement	87.60	123.00	7.65	3.02	17.690	.01

M_1 – Mean pre-test; SD_1 – Standard deviation of pre-test scores
M_2 – Mean post-test scores; SD_2 – Standard deviation of post-test scores

TABLE 2: Mean Differentials between Post-Test Scores in Various Mathematical Skills of Experimental Group 1, Experimental Group 2, Experimental Group 3 and Control Group

Skills	M_1	M_2	SD_1	SD_2	t-value	Significance
Comparison between EG_1 and CG						
Readiness	59.20	55.60	2.78	4.38	2.195	.05
Number concept	15.20	11.30	1.75	1.25	5.730	.01
Computational	32.60	19.30	3.98	5.89	5.918	.01
Problem solving	4.50	1.00	1.35	1.05	6.450	.01
Total Achievement	111.50	87.20	5.84	6.65	8.688	.01
Comparison between EG_2 and CG						
Readiness	62.40	55.60	2.37	4.38	4.322	.01
Number concept	16.40	11.30	1.43	1.25	8.487	.01
Computational	31.20	19.30	2.35	5.89	5.936	.01
Problem solving	4.30	1.00	2.11	1.05	4.423	.01
Total Achievement	114.30	87.20	5.87	6.65	9.664	.01
Comparison between EG_3 and CG						
Readiness	63.40	55.60	2.22	4.38	5.026	.01
Number concept	16.60	11.30	1.07	1.25	10.158	.01
Computational	37.80	19.30	1.03	5.89	9.785	.01
Problem solving	5.20	1.00	1.14	1.05	8.573	.01
Total Achievement	123.00	87.20	3.02	6.65	15.508	.01

M_1 – Mean post-test scores of EG_{1-3}; M_2 – Mean post-test scores of CG
SD_1 – Standard deviation of post-test scores of EG_{1-3}; SD_2 – Standard deviation of post-test scores of CG

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Dr. Taranjit Kaur, Lectruer, Rayat & Bahra College of Education, Mohali.
Professor Tehal Kohli, Chairperson (Retd.) & Emritus Fellow (UGC) Department of Education, Punjab University, Chandigarh.
Dr. Batani Devi, Senior Lecturer, Dev Samaj College of Education, Chandigarh.