

## A Remedial Intervention for Addition and Subtraction in Children with Dyscalculia

Alireza Beygi, Prakash Padakannaya, and Gowramma, I. P.

University of Mysore, Mysore

This study investigated the impact of remedial intervention on students' performance with dyscalculia in teaching addition and subtraction. Forty male students with dyscalculia (20 in experimental, and 20 in control groups) from fourth and fifth grades in Arak, Iran were the participants. The experimental group received a remedial program in addition to their regular classroom teaching (every other day). Data analysis indicated a significant increase in the subtraction and addition performance after remedial intervention. The article discusses implications for teachers, administrators, researchers, teacher training institutions, and students with learning disabilities.

**Keywords:** Dyscalculia, Addition, Subtraction, Learning Disability.

According to the DSM-IV (American Psychiatric Association, 1994) developmental dyscalculia is a rare form of learning disability (LD), with a prevalence of about 1% in the school-age population. But researches in the United States (Badian, 1983), Norway (Ostad, 1998), Israel (Gross-Tsur, Manor, & Shalev, 1996), and Europe (Kosc, 1974) have shown that 5% to 8% of school-age children exhibit some form of mathematical disabilities (MD) and associated long-term problems (Geary, 2004; Griffin & Case, 1997). With many of these students, reading disabilities (RD) and attention-deficit/hyperactivity disorder (ADHD) have been identified as co-morbid disorders (Geary, 2004; Gross-Tsur et al., 1996). Behrangi (1997 cited in Behrad, 2006) studied the prevalence of learning disabilities in primary schools (grades I, II, III, IV, and V) in Tehran, the capital city of Iran and concluded that 5.2% of the children exhibited symptoms of dyscalculia.

Children with LD often have difficulty with symbolic or abstract concepts and reasoning. These students may need extra assistance

through hands-on manipulative and pictorial representations of mathematical concepts. Hands-on experiences allow students to understand numerical symbols and abstract equations at a concrete level, making the information more accessible to all students (Maccini & Gagnon, 2000). Concrete-Representational-Abstract (CRA) is an intervention for mathematics instruction that can enhance the mathematics performance of students with learning disabilities (Baroody, 1987). It is a three-part instructional strategy, with each part building on the previous instruction to promote student learning and retention and to address conceptual knowledge. The CRA sequence of instruction incorporates the use of hands-on manipulative in the concrete stage, followed by pictorial displays in the representations phase, and in the next phase facilitates abstract reasoning with numerical symbols. Learning disabled students learning basic mathematics facts with CRA instruction show improvements in acquisition and retention of mathematics concepts (Miller & Mercer, 1993). CRA supports understanding of underlying mathematical concepts before learning rules,

and facilitates children moving from a concrete model of chips or blocks to an abstract representational ( $4 \times 3 = 12$ ). Thus CRA instructional sequence consists of three phases. The first one is concrete phase. In the concrete phase children with learning disabilities in math are provided with manipulative and other material or physical learning tools that will provide them the opportunity to explore a mathematical concept or process by actually doing it with tools. This is the stage of 'getting their hands dirty' with the intent that having an actual experience will enable the construction of the knowledge being targeted.

The second phase is the representational phase. In this phase, students with learning disabilities in math were trained to develop mental images of the mathematical manipulations by drawing on other means for understanding the target knowledge. Another way to think about this phase is to say that students with learning disabilities in math are encouraged to step back from the manipulative and other concrete tools and focus on the mathematical concept or process involved in performing actions with the tools. In the abstract phase, the third level, students with learning disabilities in math could manipulate concepts or processes in the absence of the tools that were important in the early phase of learning. The concrete-representational-abstract (CRA) teaching sequence has been found to facilitate math learning in a variety of basic skills including addition (Miller, Mercer, & Dillon, 1992), place value (Peterson, Mercer, & O'Shea, 1988), subtraction (Miller & Mercer, 1992), multiplication (Morin & Miller, 1998), division (Miller, Mercer, & Dillon, 1992), and fractions (Butler, 1999). In the present study CRA approach and the lesson program developed by Gowramma (2005), were used for remedial teaching of addition and subtraction and the effectiveness of the remediation was tested with the help of a control group.

## Method

### **Participants:**

Participants were selected through screening more than 1000 students studying in 4<sup>th</sup> and 5<sup>th</sup> grades in primary schools of Arak city in Iran for dyscalculia. Only 40 students who exhibited arithmetic disability were included in the present study. Their age range was 10-12 years. They were randomly divided into two groups - Experimental and Control groups (with 20 students in each group).

### **Measures:**

#### **Key math diagnostic arithmetic test:**

This test was meant for students from kindergarten through grade eight (Cannolley et al., 1997). It covers three aspects: A) Basic concepts (numeration: 24 items, rational numbers: 18 items, geometry: 24 items). B) Operations (Addition: 18 items, Subtraction: 18 items, Multiplication: 18 items, Division: 18 items, Mental Computation: 18 items). C) Applications (Measurement: 24 items, Time and Money: 24 items, Estimation: 18 items, Problem Solving: 18 items). A correct response by the students received a score of one and a wrong response received a zero score. The students' final scores would correspond to total correct responses. This test was used as a criterion measure in both pre and post intervention testing.

**Wechsler Intelligence Scale for Children-III):** It is a battery of tests for 6 to 17 years old. The WISC-III consists of two sets scales, the verbal scale and the performance scale. Each of these scales has several subtests. The verbal scale measures include language expression, comprehension, and the ability to apply these skills to solving problems. The examiner presented the questions orally, and the participants gave spoken response. The performance scale assesses non-verbal problem solving, perceptual organization, and speed and visual-motor proficiency. The standard procedure of administration was followed.

**Children’s Behavior Questionnaire** (Proforma B): It consists of 26 items indicating presence or absence of common behavioral and emotional problems as seen in school setting. The items describe behavior against which the teacher is asked to indicate whether each description ‘does not apply’, ‘applies to some extent’ or ‘definitely applies’ to the child. Each of these responses is scored 0, 1, and 2 respectively. The scores on each item are added together to produce a total score. The scale has been shown to have a test-retest reliability of 0.89 over a 3-month period and inter rater reliability of 0.72.

*DSM-IV (1994)* suggests 12 item check list for identifying dyscalculia (mathematics disorder), which are completed by teachers. Teachers rate students on each of the items and decide whether an item can be definitely applied or not. The ratings are 0, and 1 (0 stands for “No” and 1 stands for “Yes”). The total score is the combination of the scores of all items.. Standard procedure as mentioned in the manual was followed.

**Procedure**

The study was carried out in three phases:

Phase I: Screening and pre-test: In the first phase, the investigator approached the primary school authorities and teachers in order to get their consent for conducting the study, and also to be directed to the students who don’t have satisfactory performance in mathematics (meaning those who don’t receive acceptable scores in mathematics). Out of the total population of 1000, their teachers selected 300 students. Finally, 40 students out of 300 were found to be having dyscalculia and were selected for this study. The investigators put them randomly into control and experimental groups (20 students in each group). All the 40 students had the following characteristics:

1- Arithmetic disability (scored 70 and below in Key math diagnostic arithmetic test,

and scored above 5 in the check list of DSM IV).

2-Adequate intelligence (IQ 90 and above as assessed by WISC-III)

3-No behavioral and emotional problems (scored 9 and below through as assessed by Rutter’s Proforma B)

Phase II: After selection, the experimental group received remedial teaching based on CRA and Gowramma’s lesson program. Remedial teaching was done in Learning Disability Centre in Arak city, in 30 sessions (every second day). Each session was for 65 minutes. Gowramma’s teaching module consisted of six broad units: Pre –requisite skills (26 lessons), Number concept (29 lessons), Addition (25 lessons), Subtraction (23 lessons), Multiplication (23 lessons), and Division (17 lessons). In this study we employed addition and subtraction lessons only (contents of lessons are given in tables 1 and 2). Work sheets designed on the basis of CRA with pictorial representations were given to experimental group during every session.

**Table 1: Lesson scheme for teaching subtraction**

SPECIFIC OBJECTIVES OF EACH LESSON IN SEQUENTIAL ORDER
Lesson 1 To learn the terms and symbol of subtraction
Lesson 2 To understand that subtraction means to take away things
Lesson 3 To make familiar with all terms used in subtraction
Lesson 4 To understand the concepts of subtraction
Lesson 5 To understand the procedure of subtraction
Lesson 6 To understand single digit numbers
Lesson 7 To subtract a number from the same number
Lesson 8 To subtract one from a number
Lesson 9 To make familiar with all terms used in subtraction

Lesson 10 To learn that subtraction is the reverse process of addition  
 Lesson 11 To subtract a one digit number from a two digit without borrowing  
 Lesson 12 To subtract a one digit number from a two digit with borrowing  
 Lesson 13 To subtract a two digit number from a two digit without borrowing  
 Lesson 14 To subtract a two digit number from a two digit number with borrowing  
 Lesson 15 To subtract horizontally  
 Lesson 16 To subtract a three digit number from another three digit number without borrowing  
 Lesson 17 To subtract a three digit number from another three digit number with borrowing from ten's place.  
 Lesson 18 To subtract a three digit number from another three digit number with borrowing from hundred's place  
 Lesson 19 To subtract a three digit number from another three digit number with borrowing from both ten's and hundred's place  
 Lesson 20 To subtract one digit number from a three digit number  
 Lesson 21 To subtract two digit number from a three digit number  
 Lesson 22 To subtract any number from another number up to four digit numbers.

not exceeding 10)  
 Lesson 7 To understand that when the order of the addends change, the sum remains the same  
 Lesson 8 To familiarize addition if doubtless  
 Lesson 9 To add one to a number  
 Lesson 10 To add zero to a number  
 Lesson 11 To add single digit number with another single digit number  
 Lesson 12 To add three or more single digit number  
 Lesson 13 To add a two digit number to a one digit number without carrying over  
 Lesson 14 To add a two digit number to another two digit number without carrying over  
 Lesson 15 To add a two digit number to another two digit number with carry over  
 Lesson 16 To add three or more groups of two digit numbers  
 Lesson 17 To add horizontally  
 Lesson 18 To add three or more groups of one and two digit  
 Lesson 19 To add a three digit number to a three digit number without carry over  
 Lesson 20 To add a three digit number to a three digit number with carry over the tens place  
 Lesson 21 To add a three digit number to a three digit number with carry over to hundred's place  
 Lesson 22 To add a three digit number to a three digit number with carry over to tens and hundred's place  
 Lesson 23 To add three or more groups of three digit numbers  
 Lesson 24 To add three or more groups or four, three and two and one digit numbers  
 Lesson 25 To solve simple daily life problems involving additon

**Table 2: Lesson scheme for teaching addition**

SPECIFIC OBJECTIVES OF EACH LESSON IN SEQUENTIAL ORDER
Lesson 1 To learn the terms and symbol of addition
Lesson 2 To understand that addition means putting together things
Lesson 3 To make familiar with all terms used in addition
Lesson 4 To understand the concept of addition
Lesson 5 To understand the procedure of addition
Lesson 6 To add single digit numbers (sum

Phase III: Post test was administered after two weeks of completing the intervention teaching. Key math diagnostic arithmetic test, was given to participants of both experimental and control groups. Later, a master chart was

prepared and the data were entered to the computer for further computations.

### Results and Discussion

Table 3 presents the means and standard deviation of both the groups in pre/post-tests for two mathematical operations viz., addition and subtraction. Data were analyzed using analysis of covariance (ANCOVA) with the pre-scores considered as covariates, and by 't' test. ANCOVA revealed significant improvement in the addition test performance after remedial intervention for experimental group ( $F=23.40$ ;  $p<.000$ ). The mean pre and post-test scores of experimental group were found to be 5.75 and 10.55 respectively, whereas for the control group they were 6.25 and 6.75. Table 4 presents the summary of t-tests. There was no significant difference between experimental and control groups with respect to mean pre-test scores in addition ( $t = .907$ ,  $p<.370$ ). Also ANCOVA for subtraction showed significant improvement in the subtraction test performance after remedial intervention for experimental group ( $F=30.91$ ;  $p<.001$ ). The respective mean scores for pre and post-tests were 4.25 and 9.20, whereas the respective scores for the control group were 5.60 and 6.75. Table 4 shows that there was no significant difference between mean pre-intervention subtraction scores of experimental and control groups ( $t = 1.742$ ,

$p<.091$ ). Thus the significant improvement observed in the experiment group that underwent remedial teaching proved the effectiveness of the remedial program employed in the study. The results are in agreement with Gowramma (2005) and other researchers (Bahr & Rieth, 1989; Bolich, 1995; Chiang, 1986; Cook, Guzaukas, Pressley & Kerr, 1993; Cybriwsky & Scuster, 1990; Hasselbring, Goin & Bransford, 1988; Irish, 2002; Mcintry, Test, & Cooke, 1991; Mattingly & Bott, 1990; Morton & Flynt, 1997; Okolo, 1992; Ozaki, Williams, & Mclaughlin, 1996; Skinner, Beatty, Turco & Rasavage, 1989; Skinner, et. al., 1992; Stading, Williams & Mclaughlin, 1996; Van Houten & Rolider, 1990; VanLuit & Naglieri, 1999; Williams & Collins, 1994; Wilson & Majsterek, 1996; Wood, Frank & Wacker, 1998; Greene, 1999; Cook, & Reichard, 1996; Kroesbergen, VanLuit, & Naglieri, 2003).

**Table 3: Group means and standard deviations in pre/post –tests for addition and subtraction**

Groups	Pre Test		Post Test	
	Mean	SD	Mean	SD
Ex/Addition	5.75	1.33	10.55	3.44
Co/Addition	6,25	2.07	6.75	1.88
Ex/Subtraction	4.25	1.29	9.20	3.53
Co/Subtraction	5.20	2.06	5.60	2.43

**Table 4: Summary of "t" tests**

Test/operation	Experimental Group		Control Group		t	
	Mean	SD	Mean	SD		
Pre-test addition	5.75	1.33	6.25	2.07	.907	.370
Pretest subtraction	4.25	1.29	5.20	2.06	1.742	.091

Qualitative error analysis revealed the following pattern of errors in children with dyscalculia.

#### **Addition:**

A1: Not being aware of the basic knowledge of the addition process.

A2: Not being aware of the basic knowledge of the addition of fraction with the same denominator.

A3: Missing a digit (number) during the addition of digits in the same column.

A4: Not being able to infer as well as possible during the addition process.

A5: Not being able to add the digits (number) which appear horizontally.

A6: Not being aware of the concept of 'zero' in addition.

A7: Not being able to add decimal digit.

Table 5 presents the errors in addition performance along with an example and frequency of each particular error in both pre and post tests. One can notice that there was a drastic decrease in number of errors committed in almost all of the categories after the intervention.

**Table 5: Errors in addition performance along with an example and frequency of each particular error in both pre and post tests.**

Errors	A1	A2	A3	A4	A5	A6	A7	Total
Example	9	$\frac{1}{2}+2/5=3/10$	261	5+8=13	18+5=68	26	1.36	
	$\frac{+6}{14}$		40	5+18=23		$\frac{+50}{70}$	$\frac{+2}{1.38}$	
			$\frac{+751}{992}$	5+28=?				
Pre test/f	28	2	2	2	4	3	0	41
Post test/f	5	1	0	2	2	1	3	14

**Subtraction:**

The qualitative analysis of errors in subtraction resulted in the following categories of errors:

S1: Not being aware of the basic knowledge of the subtraction process.

S2: Subtracting the units of the first digits (number) from the units of the second digits.

S3: Not being aware of the concept of 'zero' in subtraction.

S4: Not being aware of the basic knowledge of the subtraction of fraction with the same denominator.

S5: Not being aware of the concept of the additive identity.

S6: Not being aware of the concept of the 'borrowing'

a) Not subtracting a digit from tens column after transmitting to the unit column.

b) Not subtracting a digit from hundreds column after transmitting to the tens column.

S7: Subtracting the units of tens.

S8: To leave the subtraction process incomplete.

Table 6 presents the errors in subtraction performance along with an example and frequency of each particular error in both pre and post tests. One can notice that there was a drastic decrease in number of errors committed in almost all of the categories after the intervention.

**Table 6: Errors in subtraction performance along with an example and frequency of each particular error in both pre and post tests**

Errors	S1	S2	S3	S4	S5-a	S5-b	S6	S7	S8	Total
Example	5	62	500	$\frac{7-2-5}{990}$	73	217	32	73	5.7	
	$\frac{-2}{2}$	$\frac{-5}{63}$	$\frac{-304}{204}$		$\frac{-29}{54}$	$\frac{-32}{285}$	$\frac{-11}{22}$	$\frac{-22}{1}$	$\frac{-4}{5.3}$	
Pre test/f	29	8	8	2	8	7	2	6	0	70
Pos test/f	7	2	3	4	3	4	0	3	5	31

It may be noted that the errors under the categories A7 and S8 (A7 stands for addition of decimal digits and S8 stands for subtraction of decimal digits) increased in post test situation as compared to the pre-test condition. The reason behind such an unexpected performance of students was due to the fact that those topics were not covered in the classroom at the period of administering of pre test, and hence scored zero on them. Though these topics were taught in the class by the time of post-test, the students applied this knowledge wrongly. On the whole, it could be concluded that the remedial intervention improved significantly the basic knowledge of addition and subtraction.

### References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders, fourth edition*. Washington DC: American Psychiatric Association, 48-55; 83-84.
- Badian, N.A. (1983). Dyscalculia and non-verbal disorders of learning. In H.R. Myklebust (ED). *Progress in learning disabilities*. New York: Grune & Stratton, 5, 233-264.
- Bahr, C.M., & Reith, H.J. (1989). The effects of instructional computer games and drill and practice software on learning disabled students' mathematics achievement. *Computer in the Schools*, 6, 87-101.
- Baroody, A. (1987). *Children's mathematical thinking*. New York: Teachers College Press.
- Bolich, B. (1995). The effects of a copy, cover, compare procedure and a token economy on the retention of basic multiplication facts by two midschool students with ADD and ADHD. *Journal of Special Education*, 1-10.
- Behrad, B. (2006). Prevalence of learning disabilities in Iranian primary students: a meta-analysis. *Journal of Research on Exceptional Children* 4, 417-436.
- Butler, M. (1999). *Fraction instruction for students with disabilities: Comparing two teaching sequences*. Unpublished doctoral dissertation, University of Nevada, Las Vegas.
- Chiang, B. (1986). Initial learning and transfer effects of microcomputer drills on LD Students' multiplication skills. *Learning Disability Quarterly*, 9, 118-23.
- Christenson, S.L., Ysseldyke, J.E., & Thurlow, M.L. (1989). Critical instructional factors for Students with mild handicaps: An integrative review. *Remedial and Special Education*, 10, 21-31.
- Connolly, A.J. (1997). *KeyMath Revised/NU: A diagnostic inventory of essential Mathematics*. Circle Pines, MN: American Guidance Service.
- Cook, N.L., & Reichard, S.M. (1996). The effects of children interspersal drill rations on acquisition and generalization of multiplication and division facts. *Education and Treatment of Children*, 19, 124-142.
- Cybrivsky, C.A., & Schuster, J.W. (1990). Using constant time delay procedures to teach multiplication facts. *Remedial and Special Education*, 11, 54-59.
- Desoete, A., Roeyers, H., & DeClercq, A. (2004). Children with mathematics learning disabilities in Belgium. *Journal of Learning Disabilities*, 31, 50-61.
- Geary, D.C. (2004). Mathematics and learning disabilities. *Journal of Learning Disabilities*, 37, 4-15.
- Ginsburg, H.P. (1997). Mathematics learning disabilities: A view from developmental psychology. *Journal of Learning Disabilities*, 30, 20-33.
- Gowramma, I.P. (2005). Development of remedial instruction program for children, With dyscalculia in primary school. (1<sup>st</sup> Ed). Mysore: Chethana book house.
- Greene, G. (1999). Mnemonic multiplication fact instruction for student with learning disabilities. *Learning Disabilities Research and Practice*, 14, 141-148.
- Griffin, S., & Case, R. (1997). Wrapping up: Using peer commentaries to enhance models of mathematics teaching and learning. *Issues in Education*, 3, 115-134.
- Gross-Tsur, V., Manor, O., & Shalev, R.S. (1996). Developmental dyscalculia: Prevalence and demographic features. *Developmental Medicine and Child Neurology*, 38, 25-33.
- Hanich, L.B., Jordan, N.C., Kaplan, D., Dick, J. (2001). Performance across different areas of mathematical cognition in children difficulties

- Journal of Educational Psychology*, 93, 615-619.
- Harris, C.A., Miller, S.P., & Mercer, C.D. (1995). Teaching initial multiplication skills to Students with disabilities in general education classrooms. *Learning Disabilities Research & Practice*, 10, 180-195.
- Hasselbring, T.S., Goin, L.I., & Bransford, J.D. (1988). Developing math automaticity in learning handicapped children: The role of computerized drill and practice. *Focus on Exceptional Children*, 20, 3-7
- Irish, C. (2002). Using peg-and keyword mnemonics and computer-assisted instruction to enhance basic multiplication performance in elementary students with Learning and cognitive disabilities. *Journal of Special Education Technology*, 17, 29-40.
- Kosc, L. (1974). Developmental dyscalculia. *Journal of Learning Disabilities*, 7, 164-177.
- Kroesbergen, E.V., VanLuti, J.E., & Naglieri, J.A. (2003). Mathematical learning difficulties and PASS cognitive processes. *Journal of Learning Disabilities*, 36, 572-574.
- Maccini, P. & Gagnon, J.C., (2000). Best practices for teaching mathematics to secondary students with special needs. *Focus on Exceptional Children*, 32, 1-22.
- Mattingly, J.C., & Bott, D.A. (1990). Teaching multiplication facts to students with Learning Problems. *Exceptional Children*, 56, 438-439.
- Mcintyre, S.B., Test, D.W., & Cooke, N.L. (1991). Using count-bys to increase multiplication facts fluency. *Learning Disabilities Quarterly*, 14, 82-88
- Meyer, M.S. (2000). The ability-achievement discrepancy: Does it contribute to an understanding of learning disabilities? *Educational Psychology Review*, 12, 315-337.
- Miller, S.P., & Mercer, C.D., (1992). Teaching students with learning problems in math to acquire, understand, and apply basic math facts. *Remedial and Special Education*, 13, 19-35.
- Miller, S.P., & Mercer, C.D. (1993a). Using a graduated word problem sequence to promote problem-solving skills. *Learning Disabilities Research Practice*, 8, 169-174.
- Miller, S.P., & Mercer, C.D. (1993b). Using data to learn about concrete-semi concrete- abstract instruction for students with math disabilities. *Learning Disabilities Research & Practice*, 8, 89-96.
- Miller, S.P., Mercer, C.D., & Dillon, A.S. (1992). CSA: Acquiring and retaining math skills. *Intervention in School and Clinic*, 28, 105-110.
- Miller, S.P., Mercer, C.D., Harris, C.A., Strawser, S., & Jones, W.P. (1998). Teaching multiplication to second graders in inclusive settings. *Focus on Learning Problems in Mathematics*, 21, 49-69.
- Morin, V.A., & Miller, S.P. (1998). Teaching multiplication to middle school students with mental retardation. *Education and Treatment of children*, 21, 22-37.
- Morton, R.C., & Flynt, S.W. (1997). A comparison of constant delay and prompt fading to teach multiplication facts to students with learning disabilities. *Journal of Instruction Psychology*, 24, 3-13.
- Okolo, C.M. (1992). The effects of computer-based attribution retraining on the attributions, persistence, and mathematics computation of students with learning disabilities. *Journal of Learning Disabilities*, 25, 327-334.
- Ostad, S.A. (1998). Developmental differences in solving simple arithmetic word problems and simple number-fact problems: A comparison of mathematically disabled children. *Mathematical Cognition*, 4, 1-19.
- Ozaki, C., Williams, R.L., & McLaughlin, T.F. (1996). Effects of copy cover compare drill and practice procedure for multiplication fact mastery with a sixth grade student with learning disabilities. *B.C. Journal of Special Education*, 20, 65-74.
- Peterson, S.K., Mercer, C.D., & O'shea, L. (1988). Teaching learning disabled students place value using concrete to abstract sequence. *Learning Disabilities Research*, 4, 52-56.
- Ramaa, S. (1990). Study of neuropsychological processes and logico-mathematical Structure among dyscalculics, NCERT project Report, Regional College of Education, NCERT, Mysore, India.

- Roberts, G.H. (1968). The failure strategies of third grade arithmetic pupils. *The Arithmetic Teacher*, 15, 442-446
- Rutter, M. (1967). A children's behavior questionnaire for completion by teachers: Preliminary findings. *Journal of Child Psychology and Psychiatry*, 8, 1-11.
- Shalev, R.S., Manor, O., Amir, N., & Gross-Tsur, V. (1993). Acquisition of arithmetic in normal children: Assessment by a cognitive model of dyscalculia. *DevMed Child Neurol*, 35, 593-601.
- Skinner, C.H., Beatty, K.L., Turco, T.L., & Rasavage, C. (1989). Cover, copy & compare: a method for increasing multiplication performance. *School Psychology Review*, 18, 412-420.
- Skinner, C.H., Shapiro, E.S., Turco, T.L., & Cole, C.L. (1992). A comparison of self and peer-delivered immediate corrective feedback on multiplication performance. *Journal of School Psychology*, 30, 101-116.
- Stading, M., Williams, R.L., & McLaughlin, T.F. (1996). Effects of a copy, cover, and compare procedure on multiplication facts mastery with a third grad girl with learning disabilities in a home setting. *Education & Treatment of Children*, 19, 425-434.
- Swanson, H.L., Hoskyn, & Lee, C. (1999). Intervention for students with learning disabilities: *A meta-analysis of treatment outcomes*. New York: Guilford Press.
- Van Houten, R., & Rolider, A. (1990). The use of color mediation techniques to teach number identification and single digit multiplication problems to children with learning problems. *Education and Treatment of Children*, 13, 216-225.
- VanLuti, J.E., & Naglieri, J.A. (1999). Effectiveness of the MASTER program for teaching Special children multiplication and division. *Journal of Learning Disabilities*, 32, 98-107.
- Wechsler, D. (1997). *WAIS-III: Administration and Scoring Manual*, The Psychological Corporation, San Antonio, TX.
- Williams, D.M., & Collins, B.C. (1994). Teaching multiplication facts to students with Learning disabilities: Teacher-selected versus student-selected material prompt within the delay procedure. *Journal of Learning Disabilities*, 27, 589-597.
- Wilson, R., & Majsterek, D. (1996). The effects of computer-assisted versus teacher directed instruction on the multiplication performance of elementary students with learning disabilities. *Journal of Learning Disabilities*, 29, 382-390.
- Wood, D.K., Frank, A.R., & Wacker, D.P. (1998). Teaching multiplication facts to Students with learning disabilities. *Journal of Applied Behavior Analysis*, 31, 323-338.

Received: September 04, 2008

Revision received: February 16, 2009

Accepted: June 21, 2009

**Alireza Beygi**, Department of Psychology, University of Mysore, Manasagangotri, Mysore - 570 006.

**Gowramma, I. P.**, Department of Special Education, All India Institute of Speech and Hearing, Mysore - 570 006.

**Prakash Padakannaya**, PhD, Department of Psychology, University of Mysore, Manasagangotri, Mysore - 570 006. E-mail: prakashp99@yahoo.com, prakashp99@gmail.com

# INDIAN SCHOOL PSYCHOLOGY ASSOCIATION



(Regd No.583/2009)

# 17, 14<sup>th</sup> Street, Krishna Nagar, Puducherry- 605 008, India  
www.ispaindia.org Email: indianpsychology@gmail.com

The Indian School Psychology Association is a voluntary non-profit psychological service society. The primary aim of the association is to develop and promote School Psychology, Human Values-based education and training to meet the needs of society and particularly to elevate the poor from poverty through school education. The ISPA – India is an affiliating association of the International School Psychology Association, USA and Indian Academy of Applied Psychology, India

**Governing Council:** The management of the affairs of the ISPA is entrusted in accordance with the Rules and Regulations of the association to the Governing Council of the association:

1 Dr. G.P. Thakur, New Delhi	President
2. Dr. B. Mukhopadhyay, Chennai	Vice-President
3 Dr. V. Muthu, Puducherry	Vice-President
4. Dr. Panch. Ramalingam, Puducherry	Secretary
5 Dr. S. Renukadevi, Chennai	Joint Secretary
6. Mr. V. Sendhil, Puducherry	Joint Secretary
7 Dr. B. Rangaiah, Bangalore	Treasurer

**Membership:** There shall be two classes of membership, namely

a) **Life Member:** All those who are qualified Graduates with psychology, known to be of good character in the community, may become Members of the Association and shall be members by remitting Rs.2000/- and will be called Life Members.

b) **Institutional Member:** Institutions with interests related to the Association may become Institutional Members by remitting Rs.10,000/- on one time basis

### **Special Features**

- First 100 members will get the title of “**Founder Member**”
- Quarterly update of activities will be given in the ISPA-India website
- Members will get quarterly **ISPA-India Newsletter** at free of cost.
- Members are entitled for concession in the Registration fee at the annual conferences.
- The ISPA-India has initiated National Journal for School Psychology in India.
- Members will be united with the help of State level conveners. The list of conveners is available in the ISPA-India website.
- Members will be given preferences to undergo International training in School Psychology
- Members will be recommended for participation in the International conferences on request.
- ISPA-India Best School Psychologist Award has been instituted to encourage Indian School Psychologists.
- Members may suggest best practices for School Psychology Programmes