

# Impact of Computer Aided Learning on Children with Specific Learning Disabilities

Bangalore The Spastic Society of Karnataka

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# **Impact of Computer Aided Learning on Children with Specific Learning disabilities**

**A Report on study carried out by The Spastics Society of Karnataka**

**May 2004**

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## 1 INTRODUCTION

### 1.1 Background

The issues of the disabled are becoming a part of the national education system and the planning and management of education programmes is to be seen in the context of individual learners (disabled) from the viewpoint of access, survival and success. Though a number of baseline studies have been conducted in the District Primary Education Programme (DPEP) districts, the achievement levels of disabled children have not been commented upon. Children with learning disability cannot be rehabilitated in regular schools if they are not given extra attention by teachers or do not have the teaching - learning methodology tuned to their disability. Computer technology provides the answer for many of these students. Recent advances in computer technology have much to offer students with learning disabilities, both as tools for instruction in school and as tools for life that can be used to compensate for specific impairments.

Learning is the process of acquiring and retaining knowledge so that it may be applied in life situations. Learning can become a nightmare when there are memory problems, difficulties in following directions, trouble with visual or auditory perception of information and an inability to perform paper-and-pencil tasks. Persons with learning disabilities have **specific problems** related to language (dyslexia), writing (dysgraphia) and mathematics (dyscalculia) **in spite of having near normal or above normal IQ** and not having any serious sensory disability, emotional disturbance, brain pathology etc. Millions of children have been labelled as learning disabled. These children often tend to be years behind their classmates in developing academic skills which can lead to dropping out of school. Attempts are being made to use technology to the advantage of the learning disabled. This research explores the effectiveness of computer aided learning in improving the learning outcomes of these children.

The Technology Initiatives Division at Azim Premji Foundation has launched programmes for use of computers in rural schooling. Presently, experiments are under way in some schools in rural Karnataka. The programme – Computer Aided Learning (CAL) envisages deployment of computers as a media to impact learning competencies and to create an attractive environment in the school. The state government provides the computers in schools and the required hardware while the Foundation provides the content for learning. The Foundation has developed several software content designed to aid the classroom learning process in specific areas such as mathematics, language and environment sciences. **The Spastic Society of Karnataka** conducted a research study on analyzing the impact of computer aided learning on children with specific learning problems in rural elementary schools of Karnataka.

This report provides key findings extracted from the research study.

### 1.2 Objectives

The aim of the study was to assess the effectiveness of computers in enhancing learning for children with learning disabilities. Specifically, the hypotheses for the study were

- i. The computers will enhance learning for the children in the target group.
- ii. The computers will enhance Meta cognitive aspects (self analysis, synthesis and decision making) among the target group.

### 1.3 Methodology

A screening exercise was first carried out in September 2002 followed by a baseline study in December 2002. An endline follow up study was carried out in January 2004. Four schools with Computer Aided Learning Centres in Anekal Taluk of the Bangalore rural district were selected for the study. These were Thindlu, Hebbagodi, Bannerghatta and Ballur. The universe comprised all the students from class two, three, four and five in these schools.

Children from the relevant classes were screened through psychological and psycho-educational assessment to identify those children with reading, mathematics or written expression substantially below that expected for their age, schooling and level of intelligence. The children identified were ruled out for any signs of visual, hearing, or motor disabilities, or mental retardation. Out of 1,010 children from the four selected schools, 70 children were identified as children with problems in learning.

The eclectic approach to data collection involved formal and informal assessment of the children. Psychological testing of children was done to rule out mental retardation and psycho educational to rule out defects in IQ. The psycho educational testing involved testing the children in Language and Mathematics as per diagnostic instruments used for children who were inefficient or slow learners.

<b>Subject</b>	<b>Areas covered for testing academic learning of children with learning problems</b>
<b>Language</b>	1. Oral language abilities 2. Reading (To test the child's skill in letter and word recognition), syllabication, paragraph reading. 3. Oral reading comprehension (Context clues, sentence closure and passage comprehension). 4. Written language (Informal assessment of spelling, writing and expression of ideas)
<b>Mathematics</b>	<b>Content:</b> 1. Numeration, Fractions, Geometry & Symbols <b>Operation:</b> 2. Addition, Subtraction, Multiplication, Division, Mental Computation, Numerical Reasoning <b>Application:</b> 3. Word Problems, Missing Elements, Memory, Measurements, Time

Interviews were conducted with concerned class teachers and observations of the children were made in the classroom and the Computer Aided Learning Centre. The anthropometric measurements were done to identify the current health status of the target group to rule out any effect of physical deformity.

A team consisting of medical and paramedical professionals carried out anthropometric measurements of all the school going children under study (target group). The task of collecting relevant information about the ecological aspects of the target group was carried out by a team of educators. A team of investigators, consisting of research consultant, educators, psychologists and therapists performed the educational and psychological evaluation of the target group to understand the current level of performance.

Tools for data collection used included The Binet-Kamath Test of Intelligence (Indian Adaptation) and various Educational Evaluation. The details are provided in the annexure.

#### 1.4 The terms used

An explanation for some of the frequently used terms in the report is given below.

Learning disabilities: Specific learning disability (LD) means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have problems that are primarily the result of visual, hearing, or motor disabilities, or mental retardation, emotional disturbance, or of environmental, cultural, or economic disadvantage.

Slow learner: This is a term used to describe a child whose learning ability in all areas is delayed in comparison to children of the same chronological age. These children are not considered learning disabled because there is no discrepancy between cognitive expectations and academics achievements. The major problem with these children is LOGICAL REASONING.

Age: It refers to the chronological age of the child.

Ecological aspects: This includes socio economic status, the type of family, and the education of parents as gathered by a structured interview schedule.

**Academic performance:** The percentage of marks in the subjects as recorded from the previous year's record and the values from the teacher rating scales.

**Meta cognitive aspects:** It is the self analysis of his / her learning style and skill.

## 2 FINDINGS

### 2.1 Children with Learning Problems

A total of 1,010 students formed the universe of children in classes three to six in the concerned schools. Of these, 73 children were identified as having learning problems representing a proportion of over 7.2%. The school wise details are given below.

**Table 1: School wise Distribution of Slow learners and Children(class 3 through class 6) having specific Learning Problems**

	Ballur	Thindlu	Hebba-godi	Bannerghatta	TOTAL
Total number of Children	258	122	483	147	<b>1010</b>
<b>Children identified as slow learners*</b>	7	9	5	7	<b>28</b>
<b>Children having specific learning problems**</b>	10	8	13	14	<b>45</b>
<b>Number of Children with learning problems</b>	17	17	18	21	<b>73</b>
<b>% of the Total</b>	6.6	13.9	3.7	14.3	<b>7.22</b>

(\* Slow Learners - Children having global learning problems and an IQ less than 90. \*\* Specific learning problems - Children whose IQ is normal or above normal and have only specific learning problems-Like problem in reading, comprehension.)

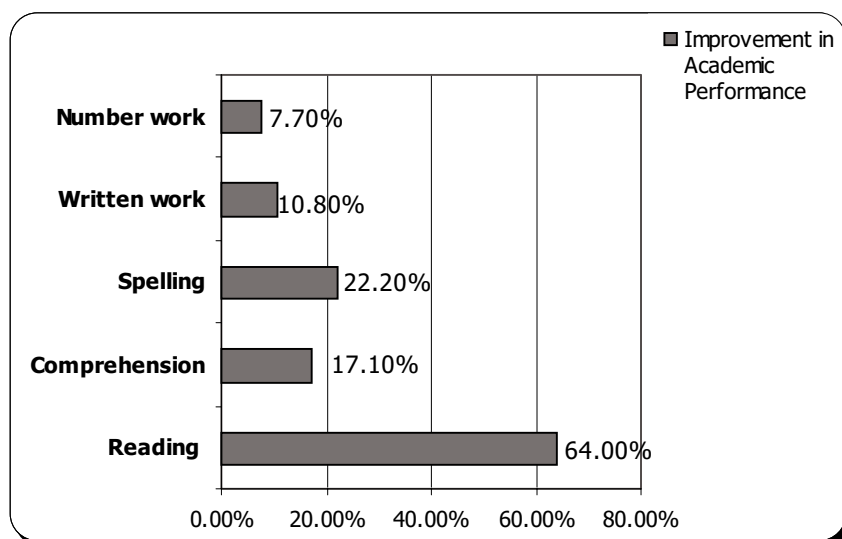
### 2.2 Impact of CALC

The impact of CALC has been assessed for the children identified as having specific learning problems. While the table above indicates 45 such children, the assessment could be carried out for only 42 children over the study period. All subsequent data and findings hence relate to these 42 children.

		Ballur	Thindlu	Hebba-godi	Bannerghatta	Total	Improvement %
Number of children		10	8	13	11	<b>42</b>	
<b>Reading</b>	Pre test	5	5	8	7	<b>25</b>	
	Post test	5	4	3	4	<b>16</b>	64.0%
<b>Comprehension</b>	Pre test	6	5	13	11	<b>35</b>	
	Post test	1	1	2	2	<b>6</b>	17.1%
<b>Spelling</b>	Pre test	8	5	12	11	<b>36</b>	
	Post test	3	0	2	3	<b>8</b>	22.2%
<b>Written work</b>	Pre test	6	7	13	11	<b>37</b>	
	Post test	0	1	1	2	<b>4</b>	10.8%
<b>Number work</b>	Pre test	10	8	11	10	<b>39</b>	
	Post test	1	0	1	1	<b>3</b>	7.7%

(**Pre test:** children below grade level. **Post test:** children showing improvement from the pre test)

**Table 2: Academic Performance of the Target Group**



**Figure 1: Impact on Academic Performance of Target Group**

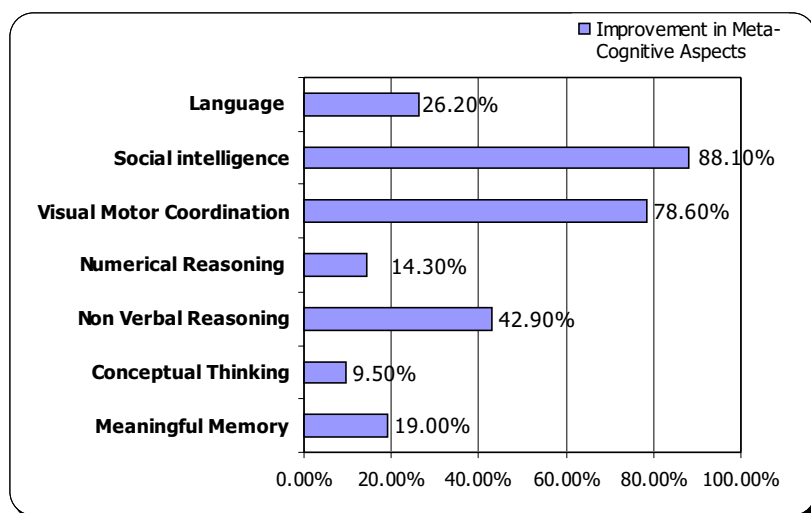
As seen in the figure, a significant number of children (64%) show great improvements in the area of reading. At the time of the baseline test, the children were seen to perform below grade level reading and when tested at the end line they were seen to demonstrate grade level reading abilities.

While some improvement is seen in spelling, areas of comprehension, written work and numerical reasoning show only marginal improvement.

**Table 3: Meta Cognitive Aspects of the Target group as tested through The Binet – Kamath Test**

(The numbers indicate the number of children who have shown improvement)

	Ballur	Thindlu	Hebba-godi	Bannerghatta	Total	Improvement %
Number of children	10	8	13	11	42	
Meaningful Memory	1	0	0	7	8	19.0%
Conceptual Thinking	0	1	2	1	4	9.5%
Non Verbal Reasoning	6	4	5	3	18	42.9%
Numerical Reasoning	0	2	4	0	6	14.3%
Visual Motor Coordination	9	6	10	8	33	78.6%
Social intelligence	9	7	12	9	37	88.1%
Language	3	2	5	1	11	26.2%



**Figure 2: Impact on Meta Cognition of Target Group**

Most of the children (88.1%) show improvement in **Social Intelligence** which measures practical common sense understanding of everyday social situations and acceptance of conventional standards of behavior. There is also significant improvement in **Visual Motor Coordination** (78.6%) that involves the sensory perception (visual), their interpretation in the brain, along with the ability to voluntarily control muscles and relate them to manipulative skills of handling raw material.

As is seen in reading, there is improvement in many children (26.2%) in **Language** which implies that there is improved ability of the children to use language to communicate their mental images to another person as well as to understand language meanings and functions. **Non Verbal Reasoning** (42.9%) is another area of improvement where children are seen to perceive and analyze patterns better and experience enhanced comprehension abstract units non-verbally

Marginal improvement is seen in the areas of **Meaningful Memory** (child's ability to recall organized knowledge of the world, the verbal world of words and how they are used). **Conceptual Thinking** (logical processes, intellectual maturity, ability to handle abstract ideas, to see relationship and the ability to generalize) and **Numerical Reasoning** (powers of arithmetic reasoning, one ability with numbers and numerical operations and taps concentration attention skills) show relatively lower improvement under 15%.

### 3 CONCLUSIONS

The findings of the study show several areas where computer aided learning has had a significant beneficial impact on the children with learning problems. At the same time, there has little or no improvement in some other areas.

Specifically, improvements are seen in the following –

1. Most children show improvement in visual motor coordination, social intelligence and non verbal reasoning.
2. There is tremendous improvement in social behavior, attention, language (oral) and communication and motivation.
3. The computer aided learning has had a positive impact in promoting the reading skills of the children, especially automaticity in reading. Generalized reading capabilities increased in nearly all the children. Improvements were also seen in aspects of speed and expression, accuracy and clarity.
4. To an extent, technology has enhanced language processing and memory of the children. This was seen through improvements in spelling which is defined as a visual and auditory processing ability.

However, the following areas do not show much improvement.

1. There was no clear impact on higher order comprehension of factual information. i.e. analytical thinking and reasoning skills. The children require guidance in using the curriculum software that is meant to improve comprehension and concept understanding skills.
2. Numerical reasoning and thinking skills need improvement. Intensive application and coaching is required as number work involves analytic thinking and reasoning.
3. Very few children have shown improvement in written expression but accessing the Computer Aided Learning Centre has improved their motivation to write and use a variety of words. Improvement is seen in ideation (i.e. content and vocabulary) and the length of sentences.

In sum thus, the use of technology does show beneficial impact on the children with specific learning disabilities. Further improvement in other areas is possible by providing orientation and suitably training the teachers concerned.



#### 4. ANNEXURE

##### Tools for data collection

##### A. The Binet – Kamath Test of Intelligence – Indian Adaptation

This test is a measure of overall level of intellectual functioning. It measures the level of functioning in the following areas – languages, meaningful memory, non-meaningful memory, visual memory, conceptual thinking, non-verbal reasoning, verbal; reasoning, numerical reasoning, visual-motor co-ordination and social intelligence. A cognitive profile was obtained thus quantifying the level of functioning in each of the following areas - language, memory for meaningful material, memory for non-meaningful material, thinking capacity, non-verbal reasoning, verbal reasoning, numerical reasoning, visual-motor co-ordination, and social intelligence. The Intelligence Quotient (IQ) obtained is used to categorise the child as learning disabled or a slow learner.

##### B. Educational Evaluation

1. Diagnostic Test of Learning Disability has VII sub-tests, which assess children's processing abilities. These are individually administered tests. They provide information about the child's visual and auditory perceptual abilities. These tests also help teachers to identify children who are 'AT RISK' and will show up problems in reading, writing or mathematics.
2. Keymath Diagnostic Arithmetic test is an individually administered test to provide a diagnostic assessment of skill in Mathematics, Keymath test items are divided into 14 sub-tests organised into three major areas.

##### Content

- a. Numeration
- b. Fractions
- c. Geometry &  
Symbols

##### Operation

- d. Addition
- e. Subtraction
- f. Multiplication
- g. Division
- h. Mental Computation
- i. Numerical Reasoning

##### Application

- j. Word Problems
- k. Missing Elements
- l. Memory
- m. Measurements
- n. Time

3. Informal assessment materials are non-standardised tests. They are helpful in assessing children's educational needs. The test questions are gathered from several teachers and psychologists. Informal assessment procedures include checklists on the following:
  - a. Oral language abilities
  - b. Reading (to test the child's skill in letter and word recognition), syllabication, paragraph reading
  - c. Oral reading comprehension (context clues, sentence closure and passage comprehension)
  - d. Written language (informal assessment of spelling, writing and expression of ideas)
4. Curriculum based testing materials test the child's concept understanding and reasoning skills. The purpose of this assessment is to estimate the child's level of understanding of concepts in Science and Mathematics.