COMPUTER-SUPPORTED INSTRUCTION IN ENHANCING THE PERFORMANCE OF DYSCALCULICS

By

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ABSTRACT

The use of instructional media is an essential component of teaching-learning process which contributes to the efficiency as well as effectiveness of the teaching-learning process. Computer-supported instruction has a very important role to play as an advanced technological instruction as it employs different instructional techniques like powerpoint presentations, video presentations etc. The use of computers in the classroom encourages active learning and meets the diverse needs of the learners through the use of technology in education.

Dyscalculia is a learning disorder in which pupils face severe difficulties in performing mathematical computations. Innovative use of computer technology may help dyscalculics to overcome their disability to a large extent. Research studies (Lugo, 2004; Mohankumar & Rajaguru, 2001; Calhoon, 1999; Nwaizu & Ifeanyi, 1990) reveal how multimedia computer technology could be effectively used as a potential supplemental teaching aid rather than traditional classroom instruction.

The present investigation examined the effectiveness of using computers for teaching mathematics to dyscalculic children. The Pre-test and Post-test of Equivalent Group Experimental Design was followed for conducting the study. The sample comprised of 20 dyscalculic students at the primary level each for the experimental group and the control group. The tool used was an achievement test in mathematics prepared by the investigators. 't' test for independent group was employed for the analysis of data. The results of the study indicated that computer-supported instruction enhanced the mathematical ability and academic performance of dyscalculic children.

Keywords: Dyscalculia, Computer-supported Instruction.

INTRODUCTION

The use of instructional media is an essential component of educational technology which contributes to the efficiency as well as effectiveness of the teaching-learning process. Teaching with the help of technological devices brings desired improvement in the teaching-learning process by making necessary modifications in the teaching and learning skills. It could bring a change in the behaviour of the learners by maximizing their learning facilities.

Learning disability is a widespread issue in today's society. Learning disabilities are disorders that interfere with the development of the basic skills such as reading, writing and arithmetic. Children with learning disabilities like dyscalculia are found in most schools. Technology can play a very important role in the learning of such pupils with arithmetic disabilities. The use of technological devices helps in the development of academic skills to reach normalcy.

Dyscalculia

Dyscalculia is a learning disorder in which pupils face severe difficulties in performing mathematical computations. The term dyscalculia is the most widely used term for the learning problems and difficulties in mathematics faced by the learning-disabled children (Mangal, 2007). Dyscalculic children may have average or above average intelligence and also they may be slow learners, average learners or even gifted children. These children are at-risk for being seen as less capable than they are. However they have the general ability to learn

that is comparable to or higher than many of their peers (http://www. Learning disabilities. about.com). But they apparently cannot use information transmitted by the senses to the brain as accurately as most other children. Therefore they may do poorly in school or not as well as they can.

There are numerous learning problems faced by dyscalculics in doing mathematical calculations. Mathematical disabilities comprise computational problems in addition, subtraction, multiplication or division and failure in application of mathematical rules and conceptual problems such as poor understanding, difficulty in discriminating relevant and irrelevant aspects of problems of mathematics, poor number sense, poor discrimination between shapes, sizes and quantities, poor spatial orientation etc. Dyscalculics have disturbances related to reading and writing numerals and symbols, and also disturbances in visual-motor integration, either for writing or for non-verbal motor skills (Chadha, 2006).

Computer-supported Instruction

Computer-supported Instruction (CSI) refers to the instruction by the teacher with the support of computer in which the features like text, images, graphics, animation etc are incorporated. In other words, CSI is the teacher-assisted instruction with computer as the teaching aid. It encourages active learning and meets the diverse needs of the learners through the use of technology in education. It can cater to the individual needs of many students at a time. This type of instruction produces learning experience effectively and efficiently. A good amount of information stored in the computer is made available to the learner than any other media (Mohanty, 2003).

CSI for this study included the features such as powerpoint presentations and video presentations. Multimedia computers can present any type of auditory or visual materials including speech, text, music, animations, photographs or videos alone or in different combinations. They can link different types of representations such as pictures with sounds, oral readings with written text, videos with subtitles or any other combinations that might reinforce teaching and learning. They can also provide enormous flexibility, allowing the user to set the speed of speech, decide whether written text is also read aloud, choose the language presented in text and speech, or decide whether to repeat the presentation (http:// www. neirtec.org/reading_report/report.htm). This flexibility can be valuable in presenting educational tasks to dyscalculics to improve their mathematical skills.

CSI for Dyscalculics

Technology can greatly aid the process of mathematical exploration and clever use of such technology can help to engage such students with arithmetic learning deficiencies. The use of technology like computer-assisted instruction may be a help in effective learning. Data handling, graphical representation and visualization are important skills which can be taught productively to these children. Students' spatial reasoning and visualization can be enhanced through visual learning which fosters better understanding, organization and imagination (NCERT, 2005). Innovative use of computer technology may help dyscalculics to overcome their learning problems to a great extent. Computer technology provides visual learning which involves the use of different video and powerpoint presentations with attractive pictures, diagrams and graphs along with mathematical formulae, mathematical statements or rules. All these provide variety in learning to dyscalculic learners.

The innovative use of technology supports mathematical learning of students by developing computational fluency and conceptual understanding, creating mathematical representations, organising ideas, developing problem solving and reasoning (Hasselbring *et al*, 2006). A study conducted by Lugo (2004) on the problem-solving skills in Algebra of ninth grade students with learning disabilities explores how multimedia computer technology could be a potential supplemental teaching aid that teachers use in addition to traditional classroom instruction. Another study (Mohankumar & Rajaguru, 2001) which evaluated the effect of using multimedia instructional strategy for learning-disabled

children suggested that multimedia instruction facilitated the learning-disabled students in learning algebra concepts rather than their counterparts in conventional teaching group. The above research studies reveal how multimedia computer technology could be effectively used as a potential supplemental teaching aid rather than traditional classroom instruction.

The use of technology like computer-assisted instruction (CAI) may facilitate the process of mathematical exploration in dyscalculic learners. By these specialized approaches to teaching, most dyscalculic learners can be helped to learn normally (Kumar & Raja, 2008). Nwaizu and Ifeanyi (1990) on assessing the level of retention of students with specific learning disabilities while using CAI and teacher-assisted instruction (TAI) to teach multiplication skills found that students had higher retention level of multiplication facts mastered during CAI than during TAI. Calhoon (1999) conducted a study to know the effects of computer-based test accommodations on mathematics performance assessment scores for secondary students with learning disabilities, the results suggested that providing a reader, either human or computer significantly increases mathematics performance assessment scores for students with learning disabilities.

Significance of the Study

A learning disability like Dyscalculia cuts across class, age and intelligence. Most schools may have some dyscalculic children. An awareness that there are certain teaching methods and practical approaches which are effective with such children is essential for class teachers particularly of primary schools. This study will be of relevance to various teachers dealing with children facing dyscalculic disabilities.

If any subject area of study presents problematic situations for sensitive learners in this category and evokes wide critical or satirical comments in school or at home, it is Mathematics. It has become quite the social norm for most pupils to say that Mathematics is a hard subject. Learning-disabled pupils, where Mathematics is concerned are children with special needs. They have as much right as others to learn Mathematics and their needs have to be addressed seriously. The conceptual world of Mathematics can bring great joy to these children and it is the responsibility of educators not to deprive them of the pleasure of such an education.

This study will be highly beneficial in the current educational scenario as it seeks to ensure the efficient teaching method for dyscalculics to assimilate mathematical concepts through computer-supported instruction. Therefore a study on the effectiveness of computer-supported instruction on the performance of dyscalculic students at the primary level is found to be significant.

Objectives

The study has the following objectives.

- To find out whether there is any significant difference between the pre-test scores of the control group and the experimental group
- To find out whether there is any significant difference between the post-test scores of the control group and the experimental group
- To find out whether there is any significant difference between the gain scores of the control group and the experimental group

Hypotheses

In the light of the objectives, the following hypotheses were set up for the present study.

- There is no significant difference between the pre-test scores of the control group and the experimental group.
- There is no significant difference between the post-test scores of the control group and the experimental group.
- There is no significant difference between the gain scores of the control group and the experimental group.

Methodology

The pre-test and post-test equivalent group experimental design was used for the present study. Two groups of students studying in Standard V equivalent with regard to

the aspects namely intelligence and mathematical ability were selected as the control group and the experimental group respectively.

Sample

The investigators have selected two matriculation schools of Kanyakumari district in Tamil Nadu, India to serve as both experimental and control groups respectively. There were 20 Standard V students in each group. All the sample students in both the groups were identified as dyscalculics by conducting a mathematical ability test prepared by the investigators for screening those children.

Tool used

The investigators have constructed and validated an achievement test in mathematics consisting of 24 objective type questions. The investigators set the questions from the topics such as "Fractions Four Fundamental Operations", "Ratio and Proportion" and "Geometry Circles". These questions were set on the basis of different objectives such as knowledge, understanding, application and skill.

Treatment

The students of control group were given conventional method of instruction and the students of experimental group were given computer-supported instruction. The investigators chose the topics such as "Fractions Four Fundamental Operations", "Ratio and Proportion" and "Geometry Circles" for giving instruction to the Standard V students, who are dyscalculics. The mathematical ability test used for screening showed that the sample students were weak in the areas such as visual-spatial problems, difficulty in identification of signs and symbols, difficulty in discrimination of shapes, difficulty with the concept of place value and fractions, difficulty in performing the basic fundamental operations of addition, subtraction, multiplication, division etc. During the experiment, the topics "Fractions Four Fundamental Operations", and "Ratio and Proportion" were taught through Video presentations and the topic "Geometry Circles" was taught through Powerpoint presentation. The Video presentation incorporated instruction through videos with the help of moviemaker. The Powerpoint presentation incorporated instruction with the help of animation and slideshows through different colours, graphics and images. The treatment lasted for 18 days (18 x 45 minutes).

Data Analysis

For the verification of the hypotheses, suitable statistical methods have been adopted. The statistical techniques employed for the analysis of data were mean, standard deviation and 't' tests for independent groups.

In Table 1, since p value is greater than 0.05, the null hypothesis is accepted at 5% level of significance. Hence it is concluded that there is no significant difference between the pre-test scores obtained by the control and the experimental groups.

In Table 2, since p value is lesser than 0.01, the null hypothesis is rejected at 1% level of significance. Hence it is concluded that there is significant difference between the post-test scores obtained by the control and the experimental groups. The mean scores show that the experimental group performed better than the control group in the post-test.

In Table 3, since p value is lesser than 0.05, the null hypothesis is rejected at 5% level of significance. Hence it is concluded that there is significant difference between the gain scores obtained by the control and the experimental groups. The mean scores show that the experimental group performed better than the control group.

Group	Size	Mean	Std. Deviation	't' value	p value
Control	20	18.30	4.81	0.58	0.564
Experimental	20	17.50	3.82		

Table 1. Difference between control and experimental groups in their pre-test scores

Group	Size	Mean	Std. Deviation	't' value	p value
Control	20	45.00	5.45	2.77	0.009**
Experimental	20	49.45	4.69		

Table 2. Difference between control and experimental groups in their post-test scores

Scores	Size	Mean	Std. Deviation	't' value	p value
Pre-test	20	26.70	6.71	2.374	0.023*
Post-test	20	31.95	7.27		

Table 3. Difference between control and experimental groups in their gain scores

Findings

- There is no significant difference between the pre-test scores of the control group and the control group.
- The post-test scores of the experimental group is more than that of the control group.
- The gain scores of the experimental group is more than that of the control group.

Implications

There is a great challenge on the part of teachers to deal with those children with arithmetic disorders by using innovative teaching strategies. It is necessary that teachers understand the psychology of each and every child and identify the challenges faced by the children in learning mathematics. Early identification and prevention are needed through intervention strategies for any category of dyscalculic problems of the schoolchildren. Computer-supported instruction (CSI) as an innovative strategy could be implemented in all educational institutions for the benefit of all learners who face severe problems in learning mathematics. It can be certain that those with learning difficulties in mathematics could enhance their performance in academics at least to some extent through the use of computers in the classroom.

CSI may prove to be a boon for those dyscalculic children with visual perceptual difficulties. It can enhance the performance of such children in visual processing through video as well as powerpoint presentations. The use of such presentations fosters better understanding, organization and imagination. For such learners, mathematics that allows them to learn through pictures, diagrams etc will be more appealing and hold their interest much more effectively.

Schools can implement certain academic accommodations and modifications to help the mathematically disabled children to catch up with the rest of the class. For instance, introducing mathematical laboratories may help these challenged learners to overcome their problems. Students can benefit from benefit from visual representations of pictures, diagrams etc through the use of CSI.

Using such instructional methods, dyscalculics made to develop their arithmetic skills. In addition to developing mathematical skills, CSI helps such learners to maintain a high self-esteem. The adoption of Computer-supported instruction as an innovative strategy could create a wide range of learning opportunities for such educationally backward learners. Computer-supported Instruction caters to the needs of diverse learners by adopting different ways of presenting the information. Thus it helps to enhance the learning of such pupils by integrating educational technology in the classroom.

Recommendations for Further Researches

Mathematical skills are indispensable for academic excellence and more researches in this area are becoming increasingly needed. It is essential for researchers to investigate about the effectiveness of Computer Supported Instruction for dyscalculics in relation to dyslexic or dysgraphic problems. The dyscalculics need to be identified and studied at all levels of schooling primary, secondary and higher secondary, and at tertiary level. Locale-specific studies in the area of dyscalculia are lacking and attempts have to be made on this.

Awareness about dyscalculia is very much essential to investigate about new technologies that can be most appropriately used to facilitate the learning of mathematically disabled children. It is imperative to study about ICT technologies like Web-based learning and investigate the effectiveness of different communication technologies such as e-learning, ubiquitous learning (u-learning) on the mathematical ability of such learners. Also experimental studies, both culture fair and culture specific, on innovative methods of instruction which may benefit these arithmetic-disabled children other than the computer technologies are to be done widely for the sake of developing countries. Hence researchers are required to study more about this disorder and search suitable measures to treat these disabled learners.

Conclusion

Computer-supported instruction (CSI) is thus found to be an effective strategy in enhancing the performance of

dyscalculic children. It is necessary for teachers to get rid of technophobia and be familiar with all aspects of computer technology. With proper guidance given by the teachers, dyscalculics can be made to do arithmetic calculations in correct ways. In addition, these disabled students need a great deal of structured practice and immediate corrective feedback to develop their numerical skills. It is essential that teachers adopt CSI in the classroom to meet the needs of dyscalculics so as to overcome their learning problems in mathematics. This type of instruction can help such children to overcome their learning problems and attain tangible improvement in mathematical abilities.

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