

## COMPUTER ASSISTED INSTRUCTION IN TEACHING OF MATHEMATICS: AN EXPERIMENTAL STUDY AT HIGHER SECONDARY SCHOOL LEVEL

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### Abstract

The purpose of this study was to determine the effectiveness of computer-assisted instruction (CAI) versus traditional method of instruction on Differential calculus, a chapter of higher secondary mathematics. The students in the control groups were taught the concepts of Differential calculus in their original classes, while the students in experimental groups were instructed in a computer lab. Experimental group students utilized CAI package which contains sound, animation and self-examination, allowed students to navigate and self-explore themselves. A quasi-experimental design with control and experimental groups and pre- and post-test was utilized. 180 students were selected using purposive sampling techniques from three types of government higher secondary schools in Coimbatore. Research instrument was Mathematics achievement test (MAT). A Personal information questionnaire was used to make a profile of student's demographic, Mathematics attitude scale was used as a tool prepared by the researcher to analyze the attitude of students towards mathematics. . Data analyzed using mean, S.D. Independent "t" test, paired "t" test, ANOVA and Chi-square test. The analysis revealed that there was statistically significant difference between the students' achievement in the control and experimental groups. The result explains that teachers could use computer-assisted instruction software as a useful supplemental tool. Further research is recommended to examine effectiveness of computer-assisted instruction for other chapters of mathematics at higher secondary level.

**Keywords:** Computer Assisted Instruction, Traditional teaching, Achievement test, Mathematics attitude scale.

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### INTRODUCTION

Most of the students of higher secondary schools don't prefer formal learning environment. So the faculty to be technologically empowered, updated and able to make use

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of innovative pedagogical methods and practices. The instructional activities in the classroom are based on the transfer of knowledge from the teacher to the learner. Educators have attempted to use technology to enhance mathematics instruction using technology (Duarte, 2000). Educational technology has been dramatically changed the teaching, learning process now a days. There is a strong linkage between mathematics and computers because more and more mathematics teachers have used computers in their teaching (Becker, 1991; Hargreaves et al., 2004).

Individuals come across with mathematical problems in their daily lives as consumers, citizens, and workers (Rey et al., 2007). Results of many studies indicate that in this digital world we live in, advanced mathematical and technical skills required in many professions (Xin et al., 2005). The availability of technology resources in modern classrooms have enhanced students' mathematical learning opportunities and promoted students' engagements with mathematical ideas (Goos, 2003). Computer-assisted instruction "makes possible programmed instruction which presents students with content, requires the student to respond actively, and immediately gives the student information about the correctness of the response" (Ford and Klicka, 1998, p. 7) Creativity and innovation are fundamental to all disciplines and an essential part of the learning process. They are also fundamental to teachers improving their professional practice and to school development. This research focuses on improving the students interest in learning and enjoying the beauty of mathematics thereby arousing the curiosity and enthusiasm in them. This study was a quasi-experimental design comparing traditional mathematics instruction and computer-assisted instruction, starting from reviewing previous relevant research.

## **REVIEW OF LITERATURE**

Comparative Studies on Students' Achievements on the effectiveness of CAI, Multimedia and other instructional methods using audios, videos in schools and colleges. The study of Bailey, (1991) entitled as "computer assisted instruction of mathematics" was to determine whether computer assisted instruction of mathematics produces significantly greater improvement in mathematics performance of low achieving ninth grade students than teaching mathematics skills without computer assisted instruction .

Das, A. (1998), Zyoud. M (1999) and Suwana, R. (2004) developed a CALM package, attitude of students, CAI package and found that these developed package helping the

students to learn English better. Vij and Sanjana (2003) have developed CAI package in science. In these studies the effectiveness of CAI is compared with traditional method in Science and found that CAI is more effective than the traditional method.. Khirwadkar, A. (1998) and Anjali (1999) have developed CAI package in chemistry along with attitude of students in their research studies. Vasanthi, A. and Hema, S. (2003) have developed CAI package in Chemistry for first year B.E students. It shows that well designed CAI is enhancing better learning. These researches have been based on network diagram, CAI package and syllabus based computer package LM., CAI, CAIPI (Computer Assisted Instruction with Peer group Interaction. Meera, S. (2000) developed a syllabus based CAI in Biology for XI standard students. Bhuvaneshwari, K. and Dr. Bala Subramanian, N. (2005) studied on Effectiveness of the CAI Evaluation package developed in internet and intranet as measured by Tamilnadu Professional courses Entrance Examination.

### ***Role of Mathematics***

According to Bertrand Russell (1919) “The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry” Mathematics is such a useful tool that it is considered one of the "basics" in the formal educational systems. Mathematics plays an important role to provide technically skilled manpower in our country. Mathematics is an abstract subject. The reasoning in mathematics possesses a number of characteristics, namely, characteristics of accuracy, verification of results, certainty of results, similarity to reasoning in life, originality. All these characteristics automatically become a part and parcel of a child when he learns mathematics. Students find it difficult to understand mathematics because of symbols and abstractness. The Education Commission (1964-66) recommended mathematics as a compulsory subject for all school students. Thus, mathematics enjoys a unique status in a school curriculum. Yet many school students find difficulty with learning of mathematics and fail in mathematics. A major reason for the failure is that the teachers quite often pay no attention to the basic concepts and generally adopt methods of solving questions with crammed up formulae. “Ours and previous few generations have failed to produce good mathematics teachers at school level in adequately large numbers.” The corpus of this enormous knowledge that man built over the last few centuries will be too burdensome to carry into future on the shoulders of ill-equipped school Mathematics teachers. This is so

since teaching mathematics to impressionable young minds is a specialized task that many mathematicians may not measure.

### **SIGNIFICANCE OF THE STUDY**

At present teachers handling higher secondary mathematics need to think more about the different roles he/she needs in the information society to meet the new challenges. Nowadays teaching methods have moved from teacher oriented and teacher controlled approach to pupil interactive approach. Such a system requires a number of changes in the instructional procedure and innovative methods used for effective teaching. The teachers are always in search of new tools which would help us in facilitating student learning process. Here the technology is leveraged for learning purposes and the educationists, teachers, students and all stakeholders are able to communicate anytime and anywhere and also the activities and progress of all the students and the system on the whole can be monitored, recorded, analyzed and evaluated to determine that everything is on track or to resolve issues as soon as possible.

### **OBJECTIVES OF THE STUDY**

Innovation and creativity are fundamental to all academic disciplines and educational activities. The main objective of the study is to find out the effectiveness of CAI in teaching mathematics at higher secondary level in terms of the student's performance in the achievement tests in mathematics with specific reference to certain selected variables. Other specific objectives are:

1. To identify hard topics by conducting Diagnostic test perceived by the students of class XI for developing CAI package.
2. To develop Syllabus based computer software CAI package in mathematics for class XI on the lesson 'Differential calculus'
3. Validation of CAI package for differential calculus.
4. To evaluate the effectiveness of CAI package for differential calculus.

### **HYPOTHESES OF THE STUDY**

1. There is a significant difference between the students' post test scores in the control group who received traditional teaching method and in the experimental group who received the computer-assisted instruction method

2. There is a significant difference in the attitude of experimental group students towards mathematics in the pre-test and post-test phase.
3. There is a significant difference between the achievement mean scores of students in post-test hailing from urban and rural areas with regard to experimental group.

## METHODOLOGY

The research method was quasi experimental with control and experimental groups, as well as pre- and post-tests.

### *Sample of the study:*

The sample was selected using the purposive sampling and included 90 boys and 90 girls studying in three different types of government schools. The purposive sampling was used according to availability of computers to implement CAI in participants' schools.

### **Primary data**

The following schools were purposively selected because these schools have sufficient infrastructures i.e. computer lab facilities to teach for experimental group.

### **Details of schools selected for the collection of data**

Sl. No.	Name of the school	Number of students
1	Municipal Boys Hr. Sec. School	60
2	Government Higher Secondary School	60
3	Government aided higher secondary school	60

### *Tools Used:*

- Diagnostic test(DT)
- Mathematics attitude scale(MAS)
- Mathematics achievement test (MAT)
- Computer assisted instructional package(CAI)

The instruments Diagnostic test(DT) and Mathematics achievement test (MAT) validated through test split –half technique and its reliability has been reported to be 0.80 The reliability of the instrument Mathematics attitude scale(MAS) has been estimated Cronbach's alpha reliability statistics determines the internal reliability of an measurement instrument. Researcher infer that Cronbach's Alpha is greater than the 0.5 so we concluded that all the items are reliable and also result revealed that all items are significant because the

p-value is less than the level of significant . (i.e  $p < 0.05$ ) Computer assisted instructional package (CAI) are validated by experts. A panel of three experts from mathematics and computer department and two teachers from governments school validated the CAI package. .A personal information questionnaire was also used to make a profile of participants' demographic.

### ***CAI Package***

In this study the CAI package is developed in such a way that it can be implemented in normal classroom. CAI contained topics from Four lessons (i) Functions(ii) Limits and continuity of functions (iii) Concept of differentiation(iv) Applications of differentiation from Mathematics of std. XI. A total of 75 Power Point Presentation Slides were included in the CAI. In the entire slides investigator used figure, animation whenever required.CAI helps the students to transfer of syllabus based textual learning contents to visual learning content. This transition is more effective in the learning through innovative and effective teaching methods.

### **ANALYSIS AND INTERPRETATION OF THE DATA**

**Hypothesis 1:** There is a significant difference between the achievement of students of Experimental group and the Control group in differential calculus in post test.

Table 1. The Mean, Standard Deviation, and t Value of Students' Test Scores

Group	Mean	N	S.D.	't' value	Level of significance (0.05 level)
Control group	26.77	90	4.050		
Experimental group	36.04	90	5.149	-13.502	Significant (2-tailed)

Table 1 reveals that the mean score difference between students belonging to Experimental group and the Control group in differential calculus in post test is 9.27. Also it presents that the significant value is less than .05 at 5% level of significance. This indicates there was significant difference between the achievement of students belonging to Experimental group and the Control group in differential calculus in post-test. Hence the hypothesis is accepted.

**Hypothesis 2:** There is a significant difference in the attitude of experimental group students towards mathematics in the pre-test and post-test phase.

Table 2. The Attitude of Experimental Group Students towards Mathematics in the Pre-test and Post-test Phase

Group	Mean	N	S.D	“t” value	Level of Significance (0.05 level)
Experimental group Attitude-Pre-test	173.25	90	26.367		
Attitude-Post-test	183.33	90	21.154	-3.402	Significant (2-tailed)

Table 2 presents the mean score of attitude of experimental group students towards mathematics in the pre-test and post-test phase. The mean score of experimental group (173.25) in pre-test is lower than the mean score of experimental group (183.33) in the post-test. The calculated “t” value 3.402 is greater than the table value (1.96) at 5% level of significance. This indicates that there is a significant difference with regard to the attitude of experimental group students towards mathematics in the pre-test and post test phase. Hence the hypothesis is accepted.

**Hypothesis 3:** There is a significant difference between the achievement mean scores of students in post-test hailing from urban and rural areas with regard to experimental group.

Table 3. Achievement of the Experimental Group Students in Post-test Hailing from Urban and Rural Areas

Group	N	Mean	S. D	“t” value	Level of Significance (0.05 level)
Experimental group. Post-test	1.Urban	40	27.35	4.461	Significant ( 2-tailed)
	2. Rural	50	25.00	3.682	

Table 3 presents the mean score of the experimental group students hailing from urban and rural areas in post-test. The calculated “t” value 2.135 is greater than the table value (1.96) at 5% level of significance. Hence the hypothesis is accepted.

## **FINDINGS**

Following main findings have been drawn by the investigator:

1. There was a significant difference between the achievement of students of Experimental group and the Control group in differential calculus in post test. This implies that CAI method helped the experimental group higher secondary school students to perform well in the post test comparing with control group students.
2. There was a significant difference in the attitude of experimental group students towards mathematics in the pre-test and post-test phase. This result reveals that the students of experimental group have good attitude towards mathematics after learning differential calculus by using CAI .
3. There was a significant difference between the achievement mean scores of students in post-test hailing from urban and rural areas with regard to experimental group. It indicates that students hailing from urban areas have more exposure in computer than that students hailing from rural areas.

## **CONCLUSION**

Education provides and equips students with knowledge, information, methods of thinking, creativeness problem solving and decision making Mathematics teachers working in all types of schools in our state should organize seminars, paper presentations, numerical aptitude test according to the academic level of the students in selective areas in mathematics to increase their positive attitude towards mathematics. Teachers can make use of Computer Assisted Instruction for selective topics in the school curriculum along with the conventional teaching. The researcher believe this study will have a contribution in the effort of identifying some of the major aspects, which hinder the teaching and learning of differential calculus in mathematics with the help of CAI package and thereby towards possible solutions. Therefore our education department should emphasize on the importance of making abundant systems of training with high level standards for the teaching and learning methods to teachers handling higher secondary mathematics and the efficiency of rendering to maintain creativity. This will help the students hailing from rural areas to appear JEE exams to show their ability. Hence, in the current scenario, it was concluded that computer assisted instruction in differential calculus enhances the achievement and retention of higher secondary school students of Tamilnadu.

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