

## EFFECTIVENESS OF COMPUTER BASED INSTRUCTION ON MATHEMATICS ACHIEVEMENT IN RELATION TO MATHEMATICS ANXIETY

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### Abstract

*The present study investigates the effectiveness of computer based instruction on mathematics achievement in relation to mathematics anxiety. The sample of 216 students of class IX was drawn from four different schools of Jalandhar district in Punjab. Computer based instructional material was prepared and implemented to the experimental group after pre- testing. The gain scores were computed after post-test for all the students. The data obtained were analyzed statistically with the help of mean, standard deviation and analysis of variance. An analysis of variance (2×3) was used to arrive at the following conclusions: (i) The achievement of group taught through computer based instruction was found significantly higher than that of group taught through traditional method of teaching, (ii) The achievement of students with different mathematics anxiety was found significantly different from one another in mathematics, (iii) Significant interaction effect was found between instructional strategies and mathematics anxiety on mathematics achievement.*

**Keywords:** Computer Based Instruction, Mathematics Achievement, Mathematics Anxiety



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### Introduction

Computer based instruction is an educational medium in which an instructional content is delivered through the computer. The main purpose of using computer technology is to train individuals to cope with the fast developing and changing science world and also helps them to utilize the recent technologies in every field. With the rapid development of information and communication technology, the use of computers in education has become necessity. The use of computers in education provides the students with a more suitable learning environment, serves to create and sustain interest and helps in increasing the

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students' motivation level. Hence, the use of computer technology plays a very important role in the teaching and learning process (Isman, Baytekin, Balkan, Horzum & Kiyici, 2002). Computer based instruction is one of many acronyms applied to educational or instructional software. Computer based instruction is the broadest terms and can refer to virtually any kind of computer use in educational settings, including drill and practice, simulations, tutorials, instructional management, programming, database development, supplementary exercises, writing using word processors and other applications (Cotton, 1991).

Mathematics achievement plays a very significant role for the harmonious development of a student. Mathematics achievement refers to the degree or level of success or proficiency attained in some specific areas concerning mathematics. Predictors for students' mathematical achievement are classified under two categorical factors: the psychological and the mathematical factors. Three independent variables of the psychological factors understudied are memory, interest and attitude towards mathematics. The other mathematical factors are mathematical language, thinking ability, mathematical concept and computational skills (Loo & Fong, 1996).

Mathematics anxiety refers to a state of uneasiness and distress about mathematics or the taking of mathematics tests. Mathematics provides a very real cause or threat to students, who have not learned how to cope with them. A student who have not prepared for a test will have the fear of failing the test. An excessive fear is certainly destructive and painful, but a reasonable amount of fear in certain situations is beneficial providing motivation to increase learning in order to perform well in the exams. Excessive anxiety results in low self-esteem and poor academic performance (Ropalje, 2006). Mathematics anxiety is defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations and can cause one to forget and loose one's self-confidence (Tobias, 1993). Math anxiety is defined as a feeling of apprehension, tension or fear that interferes with math performance (Ashcraft, 2002).

### **Need and Significance**

Mathematics is different from other subjects and must be studied differently. Mastering effective study techniques for mathematics enhances mathematics performance. Better use of time and developing a study schedule also assists in improving mathematics performance. Anxiety is only when people cannot predict or exercise control over events that

they have reason to fear them. “The computer based instruction makes teaching techniques far more effective than those of the traditional teaching methods as it is used for presenting information, testing, evaluation and providing feedback. It makes a contribution to the individualization of education. It acts as motivator for the students and students remain as active part in the whole learning process. It develops creativity and problem solving skills, identity and self-reliance in learners. Computer based instruction provides graphics, animation, drawings, music and plenty materials for the students to proceed at their own pace and in line with their individual differences. It controls lot of variables having an impact on learning, which cannot be controlled by means of traditional educational techniques” (Chang, 2002). According to Renshaw and Taylor (2000), “It has been found that computer based instruction serves to develop meta-cognitive skills in students and helps them to learn in a meaningful way instead of rote-memory learning as well as it enables the students to increase their achievements”. “According to some studies there is no significant difference between the computer based instruction and traditional teaching methods” (Bayraktar, 2001; Alacapinar, 2003).

Keeping in view the review of researches, it is observed that factors like mathematics anxiety affect the achievement in one way or the other way. Therefore, the investigator tried to investigate the effectiveness of computer based instruction on mathematics achievement in relation to mathematics anxiety.

### **Objectives**

1. To compare the achievement of group taught through computer based instruction and traditional method of teaching in mathematics.
2. To study the achievement of high, average and low groups of students on mathematics anxiety.
3. To examine the interaction effect of instructional strategies and mathematics anxiety.

### **Hypotheses**

- H<sub>1</sub>: The achievement of group taught through computer based instruction is significantly higher than that of traditional method of teaching in mathematics.
- H<sub>2</sub>: The achievement of low mathematics anxiety group is significantly higher than average and high mathematics anxiety group of students in mathematics.
- H<sub>3</sub>: There exists significant interaction effect of instructional strategies and mathematics anxiety.

## **Sample**

For the present study, four schools were drawn randomly from senior secondary schools of district Jalandhar. The schools were compared with regards to the criteria that the schools have almost same class climate, physical facilities, computer labs etc. After selecting schools, the intact sections of each school were randomly taken for experimental and control group. The test of mathematics anxiety was administered and high, average and low groups on this variable were formulated. The sample was consisted of 216 students of 9<sup>th</sup> class.

## **Design**

The present study was experimental in nature. A pre-test and post-test was employed. In order to analyze the data, 2×3 factorial analysis of variance was used. One group was treated as experimental group and the second group was treated as control group. The experimental group was taught through computer based instruction and control group was taught same topics with traditional method of teaching. The variable of instructional treatment was studied at two levels, namely computer based instruction and traditional method of teaching. The variable of mathematics anxiety was studied at three levels such as high, average and low mathematics anxiety. The main dependent variable was performance gain which was calculated as the difference in post-test and pre-test scores for the subject.

## **Tools used**

The following tools were used for the collection of data:

1. An Achievement Test in Mathematics was developed by investigator.
2. Computer based Instructional Package in Mathematics (through multimedia CD's, power point presentation) was developed by investigator.
3. Mathematics Anxiety Scale by Karimi and Venkatesan was used.

## **Procedure**

After the selection of sample and allocation of students in two groups for two instructional strategies, the experiment was conducted in various phases such as the investigator made necessary arrangements with the Principals of the schools selected for the experiment. Then, Mathematics anxiety scale was administered for the classification of the students. After that, achievement test as a pre-test was administered to the students of experimental and control group. The students were given stipulated time to complete the test. The answer-sheets were scored to obtain the information regarding the previous knowledge of the students. Then, treatment was given to the experimental group. The experimental group

was taught through computer based instruction. Lessons based on mathematics topics such as irrational numbers, polynomials, ratio and proportion, linear equation in two variables, statistics, lines and angles were taught to the students. The control group was taught the same topics through traditional method of teaching by the investigator. After the completion of the course, same achievement test was administered simultaneously as post-test to the students of both the groups. The answer-sheets were scored with the help of scoring key. The obtained scores comprised of the post test scores. Experimental and control group scores were compared according to their pre and post-test scores. The difference was called gain achievement scores.

### Analysis and Interpretation of the Results

- Analysis of Descriptive Statistics**

The obtained data were analysed to determine the nature of distribution of scores by employing mean and standard deviation. The analysis of variance (2×3) was used to test the hypotheses related to strategies of teaching and mathematics anxiety levels. The mean and standard deviation of different sub groups have been presented in table-1.

**Table - 1: Mean and S.D. of gain achievement scores for different sub groups**

Mathematics Anxiety	Teaching					
	Computer Based Instruction			Traditional Method		
	N	Mean	SD	N	Mean	SD
High	18	7.72	5.82	19	6.11	3.25
Average	34	14.53	8.67	39	10.56	5.27
Low	56	18.25	6.51	50	10.18	4.58
Total Sample	108	15.32	8.05	108	9.60	4.89

The table - 1 shows that the mean scores of computer based instruction (M=15.32) was higher than that of traditional method of teaching (M=9.60). This shows that computer based instruction strategy was more effective than that of traditional method of teaching.

- Analysis of Variance on Gain Achievement Scores**

The mean of different sub groups, sum of squares, degree of freedom, mean sum of squares and F-ratio have been presented in table - 2.

**Table - 2: Summary of Analysis of Variance (2×3) factorial design**

Source of Variance	Sum of Squares	df	Mean Sum of Squares	F-ratio
Instructional Strategy (A)	1091.81	1	1091.81	34.19**
Mathematics Anxiety (B)	1363.44	2	681.72	21.35**
A × B	259.85	2	129.93	4.07*
Error Term	6514.002	210	30.73	

\*\*Significant at 0.01 level

\*\*Significant at 0.05 level

(Critical Value 3.89 at 0.05 and 6.76 at 0.01 level)

## MAIN EFFECTS

- **Instructional Strategy (A)**

Table – 2 reveals that the F-ratio for difference in gain achievement scores of computer based instruction and traditional method of teaching is 34.19, which in comparison to the table value was found significant at 0.01 level of significance. It shows that the groups are different beyond the contribution of chance. Hence, the hypothesis H<sub>1</sub>: The achievement of group taught through computer based instruction is significantly higher than that of traditional method of teaching in mathematics, is accepted. The result indicates that achievement of group taught through computer based instruction is much higher than that of traditional method of teaching.

- **Mathematics Anxiety (B)**

Table - 2 reveals that the F-ratio for difference of mean gain scores of different groups for mathematics anxiety is 21.35, which in comparison to the table value was found significant at 0.01 level of significance. Hence, the hypothesis H<sub>2</sub>: The achievement of low mathematics anxiety group is significantly higher than that of average and high mathematics self-efficacy group of students in mathematics, is accepted. The result indicates that high, average and low mathematics anxiety group do not yield equal level of achievement in mathematics.

- **Interaction between Instructional Strategies and Mathematics Anxiety (A × B)**

Table 2 shows that the F-ratio for interaction between computer based instruction and mathematics anxiety is 4.07, which in comparison to the table value was found significant at 0.05 level of significance. It indicates that instructional teaching strategies interact with mathematics anxiety group to yield significant difference in respect of gain achievement scores. Hence, the hypothesis H<sub>3</sub>: There exists significant interaction effect of instructional strategies and mathematics anxiety, is accepted. The result indicates that there is a significant difference in gain scores on mathematics achievement due to interaction effect of instructional strategies and mathematics anxiety.

## Discussion

The present study reveals that computer based instructions were more effective on achievement in mathematics than that of traditional method of teaching. Hence, the hypothesis no. H<sub>1</sub> is accepted. The findings are supported by Santally, Boojawon and Senteni

(2004), Barot (2005), Wighting (2006), Bayrak (2008), Kanmani and Radha (2009), Serin (2011), Aggarwal (2012), Afjal, Gondal and Fatima (2014), Sessoms (2016) and Ukaigwe, Goi-tanen and Evelyn (2022) which showed that computer instruction proved significantly better than the traditional method of teaching.

For mathematics achievement with regards to mathematics anxiety, it was concluded that low mathematics anxiety group was higher than that of average and high mathematics anxiety group on gain achievement in mathematics. So the hypothesis no.  $H_2$  is accepted. The findings are supported by Zararia and Nordan (2008), Wei (2010), Gupta and Verma (2011) and Zhang, Zhao and Kong (2019) which explored that significantly difference exists in the mathematics anxiety of students based on mathematics achievement.

The interaction effect of instructional strategies and mathematics anxiety was found significant. Hence, the hypothesis no.  $H_3$  is accepted. The finding is supported by Richy and Dequito (2020) who found statistically significant relationship between mathematics anxiety and computer assisted instruction.

### **Conclusion**

The present study reveals that the achievement of group taught through computer based instruction was found significantly higher than that of group taught through traditional method of teaching. Further, the achievement of low mathematics anxiety group was found significantly higher than that of average and high mathematics anxiety group of students. However, there was significant interaction effect of instructional strategies and mathematics anxiety on achievement in mathematics. Hence, the study recommends the use of computer based instruction for better performance of the students.

### **Educational Implications**

Computer based instructions were found to be effective in increasing students' achievement as compared to traditional method of teaching. So, teachers must integrate computer instructions in their teaching learning process. In-service teachers can be given computer literacy through refresher courses so that those who are not computer literate can take benefit of this. Teachers should use innovative methods to stimulate the attention and sustain the interest of students in mathematics. So that mathematics anxiety can be reduced among students.

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