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**Theme I: Innovative Learning Applications and Practices.**

**EFFECTIVENESS OF COMPUTER ASSISTED  
INSTRUCTION IN THE SUBJECT OF MATHEMATICS  
FOR DISTANCE LEARNERS**

**Sheikh Masood, Muhammad Safdar, & Irshad Baloch**

## EFFECTIVENESS OF COMPUTER ASSISTED INSTRUCTION IN THE SUBJECT OF MATHEMATICS FOR DISTANCE LEARNERS

Sheikh Kamran Masood<sup>(1)</sup>, Muhammad Safdar<sup>(2)</sup>, and Irshad Hussain Baloch<sup>(3)</sup>

**Abstract:** Computer is the most significant and pervasive technological innovation of contemporary world and is certainly the eighth wonder of the world. Main purpose of the study was to determine the effectiveness of computer assisted instruction (CAI) for distance learners. It was an experimental study and 120 (M=60+FM=60) students of class XII (Pre-engineering) were taken as a sample of the study. For comparison purpose these 120 students were divided into two equal groups. 60 (M=30+FM=30) students were assigned to experimental group and 60 (M=30+FM=30) to control group. Effectiveness of this technology was assessed in the concepts and skills of sets and matrices, by an objective type test consisting of 100 multiple-choice questions. Marks achieved by the students of experimental group and control group were analyzed through SPSS XVII by running percentages, mean scores and t-test formulas. Main findings of the study revealed that there was a significant difference between the students of both groups. Students taught through computer assisted instruction showed better results than their traditionally taught counterparts. They showed better performance in knowledge, understanding and application level either in non text based or lower and higher level text questions.

**Key words:** Effectiveness, Computer Assisted Instruction, Students' Performance, Distance Learners



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- (1) PhD Scholar, Department of Education, International Islamic University, Islamabad (IIUI), PAKISTAN.  
e-mail: shaikhkamranmasood786@gmail.com
  - (2) PhD Scholar, Department of Education, International Islamic University, Islamabad (IIUI), PAKISTAN.  
e-mail: safdar.phdedu34@iiu.edu.pk
  - (3) Associate Professor, Department of Educational Training, Islamia University Bahawalpur, Bahawalpur, PAKISTAN.  
e-mail: irshad\_iub@yahoo.com

## INTRODUCTION

Information and communication technologies (ICTs) have revolutionized every walk of life especially education and training. Computers and its related technologies have changed the classroom scenario. These technologies have made teaching learning process easier, interesting and effective (Safdar, 2010; Amina, Yousaf, Parveen & Behlol, 2011). The computer is now considered as super-teaching machine and due to its use in instructions; various developments in the instructional technology have been witnessed as Computer Assisted Instruction (CAI), Programmed Instruction (PI), Computer Based Learning (CBL), Computer Based Instruction (CBI), Modular Approach and Web Based Learning (WBL). Keeping in view of the individual differences, individual learning and individualized instructions these methods are very useful and result oriented (Chhabra & Dhamija, 2013).

Dalton and Hannafin (1988), Price (2006), Rha and Bedell (1998), Hsiao (2001) and Raninga (2010) conducted studies to assess the effectiveness and efficacy of CAI in teaching learning of Mathematics. They found better performance of the learners educating through CAI. Moreover, secondary students exposed to CAI demonstrated higher academic achievement as compared to the students exposed to traditional instructions. Computer Assisted Instruction (CAI) has been proving an effective medium of education in the advanced countries for formal and non-formal education at all levels.

This method covers a wider range of individual differences among students. CAI is very beneficial for presenting the knowledge and instructional material automatically to the students. This method makes students more confident self-learners. CAI allows learners to learn and progress at their own pace and work individually. Konukman (2003) described some pros and cons of CAI are described which were found by (Kulik et al., 1980; Lockard, Abrams & Many 1997; Petrakis, 2000; Steffen, 1985) in their studies:

1. Performance feedback is immediate and based on the number of correct or incorrect responses.
2. Lessons are individualized.
3. The environment is paced and controlled by the learner.
4. The learner has the opportunity to backtrack for review.
5. The CAI program maintains performance records for assessment and evaluation.
6. The computer provides a useful environment for simulations.
7. CAI is time effective for instructional use in the classroom.
8. The graphics sounds, and colour offered by CAI offer a user-friendly environment.

On the other hand, these studies also reported the following disadvantages of CAI.

1. Students using CAI are isolated from peers and the school environment.
2. CAI learning is individualized rather than cooperative.
3. The instruction is offered in a dehumanization manner.
4. Teachers take on passive roles, and become facilitators rather than instructors.
5. Technical malfunctions can distract students easily.

From the above lists, one can see that the advantages of CAI outweigh the disadvantages. Computer Assisted Instruction (CAI) has influenced the educators to use it for teaching. Now-

a-days, CAI is frequently being used for teaching students at different levels. CAI is one of the most useful methods of teaching for individualized and self paced instructions to the students in classroom situations (Konukman, 2003). Moreover, higher mathematical performance was witnessed in traditional instruction supplemented with computer-assisted instructions instead of only traditional instructions (Mahmood, 2006).

According to Muhammad & Kanpolat (2010) several studies found positive outcomes when employing CAI e.g. pre mathematical knowledge (Howard, Eatson, & Ingels-YoungBrinkley, 1994), counting skills (Hungate, 1982; Nastasi, 1993), learning numerical concepts (Grover, 1986), recognizing numerals (Hungate, 1982), improvement in standardized tests of number skills (Hughes & Meclead, 1986).

Primary grade students showed largest gains in mathematics through CAI, especially when used as additional practice (Niemiec & Walberg, 1987, Ragosta, Holland & Jamison, 1981 & Lavin & Sanders, 1983). According to literature, computer and computerized instruction have their important impact on those children in the primary grades (Xin & Asha, 1999; Huang, Liu & Shiu, 2008, Hitchcock & Noonan, 2000, Fuches et al, 2006).

Clements and Nastasi (1993) estimated through their research that even 10 minutes of daily CAI practice is sufficient for significant gains. CAI is more effective as compared to traditional instructions for a wide range of mathematical skills, science, arts reading and writing. This method was proved more effective for pre-school, elementary and special education.

### **MAIN PURPOSE**

Main purpose of the study was to determine the effectiveness of computer assisted instruction (CAI) in the subject of mathematics for distance learners.

### **METHODOLOGY**

This study was conducted to compare the effects of computer assisted instructions (CAI) with traditional instructions. It was an experimental study and 60 students of class XII (Pre-Engineering) were taken as a sample of the study. For comparison purpose these 120 (M=60+FM=60) students were divided into two equal groups. 60 (M=30+FM=30) students were assigned to experimental group and 60 (M=30+FM=30) to control group. The students of experimental group were exposed to teaching through CAI, while students of control group were taught through traditional method of instructions.

Effectiveness of this technology was assessed in the concepts and skills of sets and matrices, by a teacher made post-test which was administered immediately after completing the experiment/teaching to both groups. Test was developed by the researchers with the consultation of experienced math teachers. The test contained multiple-choice questions, fill in the blanks, true/false, match the columns and short questions/answers. Reliability of the instrument was .82 (*Chronbach's Alpha*).

**DATA ANALYSIS**

At the end of the experiment post-test was administered for both the groups i.e. experimental and control. Marks achieved by the students of experimental group and control group were analyzed through SPSS XVII by running percentages, mean scores and t-test formulas.

**Table 1: Significance of difference between the mean scores of male students of experimental and control groups**

Group	Number	df	Mean	sd	SED	t-Value
Experimental	30	29	24	6	1.3	0.585*
Control	30	29	23	7		
*Not Significant			Table Value at 0.05=2.78			

Table 1 shows that the value of t (0.585) was found lesser than the table value of t (2.78) at 0.05 levels. Therefore, there was no significant difference between the mean scores of male students of experimental and control groups on previous achievements test in mathematics. Hence, both the groups were treated statistically equal.

**Table 2: Significance of difference between the mean scores of female students of experimental and control groups**

Group	Number	df	Mean	sd	SED	t-Value
Experimental	30	29	29	4.6	1.00	0.56*
Control	30	29	28	4.7		
*Not Significant			Table Value at 0.05=2.78			

Table 2 shows that the value of t (0.56) was found lesser than the table value of t (2.78) at 0.05 levels. Therefore, there was no significant difference between the mean scores of female students of experimental and control groups on previous achievements test in mathematics. Hence, both the groups were treated statistically equal.

**Table 3: Comparison of the mean scores of male students of experimental and control groups on post-test**

Group	Number	df	Mean	sd	SED	t-Value
Experimental	30	29	41	5	1.23	3.30*
Control	30	29	35	7		
*Significant			Table Value at 0.05=2.78			

Table 3 shows that the value of t (3.30) was found greater than the table value of t (2.78) at 0.05 levels. Therefore, there was significant difference between the mean scores of male students of experimental and control groups. Hence, it was concluded that CAI is effective teaching method for distance learners in contrast to traditional instructions in mathematics at FSc level.

**Table 4: Comparison of the mean scores of female students of experimental and control groups on post-test**

Group	Number	df	Mean	sd	SED	t-Value
Experimental	30	29	40	5	1.24	3.35*
Control	30	29	34	6		
*Significant			Table Value at 0.05=2.78			

Table 4 shows that the value of  $t$  (3.35) was found greater than the table value of  $t$  (2.78) at 0.05 levels. Therefore, there was significant difference between the mean scores of female students of experimental and control groups. Hence, it was concluded that CAI is effective teaching method for distance learners in contrast to traditional instructions in mathematics at FSc level.

## DISCUSSION

Main purpose of the study was to assess the effectiveness of CAI for distance learners. Results of this study revealed that CAI was effective method of teaching concepts and skills of sets and matrices in experimental group of FSc level pre-engineering group. Numerous studies have been conducted on the effects of computer use on student achievement, attitudes, learning rates, and other variables. Generally, the conclusion is that computer-assisted instruction has a positive effect on student learning.

Such results might be interpreted in the light of the fact that CAI improves learning for distance learners because students receive immediate feedback and do not continue to practice their errors (Muhammad & Kanpolat, 2010; Backer, McLaughlin, Weber & McLaughlin, 2009; Hitchcock & Noonan, 2000; MacArthur et. al., 2001). Computers are also helpful in capturing students' attention and getting high scores in mathematics. Students can learn at their pace and usually move ahead after mastering the skills (Mastropieri & Seruggs, 2000).

Several other meta-analyses and literature reviews across all ages and subject areas also concluded that computer-assisted instruction produced higher achievement, especially when combined with and not replacing traditional instruction (Bialo and Sivin-Kachala, 1996; Cotton, 1991; Edwards, Norton, Taylor, Weiss, and Dusseldorp, 1975; Kulik, 1991; Liao, 2007; Pilli, 2008; Rapaport and Savard, 1980; Thomas, 1979).

CAI provides hands on activities, supports cooperative learning and creates link between subject and the real world (Basturk, 2005). Computer programmes are interactive and through attractive animation, sound and demonstration engage students and allow them to work and progress at their own pace and work individually or in a group.

CAI provides immediate feedback to students and letting them know whether their answer is correct. If the answer is correct, well done and if the answer is incorrect, this programme guides students how to answer the question correctly (Muhammad & Kanpolat, 2010; Reiber, 1991; Smaldino et al., 2004). It is recommended that CAI may be used in teaching learning of mathematics for distance learners.

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