EFFECT OF COMPUTER BASED INSTRUCTION ON ACHIEVEMENT IN MATHEMATICS IN RELATION TO MATHEMATICS SELF-EFFICACY AND MATHEMATICS ANXIETY

A SUMMARY OF THE THESIS

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SUMMARY

INTRODUCTION

Success in mathematics is central to a good education. The better educated a society, the more successful the society. Proponents of computer technology in education argue that it makes learning easier, more efficient and more motivating (Schacter & Fagnano, 1999).

Computer based instruction is an educational medium in which an instructional content or activities are delivered through the computer. Great emphasis is given to the computer based instruction in the curriculum of education of the developed countries. 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. It serves to create and sustain interest in education and helps in increasing the students’ motivation. Hence, the use of computer technology plays a very important role in the teaching and learning process” (Isman, Baytekin, Balkan, Horzum & Kiyici, 2002).

“With the advancement in technology, computers began to be used in educational environments to develop audio and visual materials such as simulation and animation. The use of computers in the teaching and learning activities to integrate science and technology is defined as computer based instruction. The computer based teaching has an impact on the development of the educational technology to a great extent and this has resulted in the production of the instructional packages for the computer based instruction. The primary purpose of the educational instructional packages is to solve the learning problems in the science courses encountered by the students, to increase their motivation, achievements and to protect them against the negative effects of the rote-memory based educational system. The teachers used computer instructional packages as complementary materials for taking notes about their students and observations, making tables, developing materials, doing calculations and preparing simple educational software. These are used as a teaching material in the teaching as a part of a subject or the whole subject” (Alkan, Deryakulu & Simsek, 1995; Isman, 2005).

According to Alessi and Trollip (2001), “It is possible to divide educational software into five different types such as tutorial, drill and practice, educational games, simulation, and
According to Ozmen (2004), “The techniques such as presentation, demonstration, practice and evaluation of learning should be used with some classroom activities for effective and productive teaching”. According to Ozmen (2008), “The use of computer technology enables learners to be active in the learning process, to develop problem solving skills, to construct knowledge and to discover alternative solutions”.

Computer based instruction is one example where programme instruction has been combined with powerful media and technology to produce expensive and impressive learning systems. In this case, the monitoring and feedback functions of a teacher are handled by the computer. Computer instruction is based on the same principles as the ordinary programmed instruction but students work from computer terminals. They observe displays shown on monitors or typed on a computer output, instead of programmed textbooks or workbooks. Students type information into the computer or respond to it by pressing the related keys. In addition to manipulating interesting, sophisticated and responding equipment, the students find that they cannot cheat, as answers are given only to the student’s responses. It also permits the students to proceed according to their abilities and pace of learning (Sharma 2006, p. 502).

Computer based instructional material helps students to develop information and problem solving skills, to be active in the learning process and to find alternative solutions of the problems, which further give rise to positive changes in the lives of people. The use of problem solving skills is inevitable at every stage of our daily lives. As a result of the advancement in computer technology, it is essential to use computer technology to find the solution of educational problems. The various advantages of computer based instruction are (Sharma 2006, p. 165):

- **Immediate Feedback**: Students remains active as well as immediate feedback keeps students interacting and eager to keep trying.
- **Active Participation**: Computer based instruction helps the students to participate actively especially in case of weaker students because they often remain passive in lectures.
- **Patience**: The computer waits patiently for an answer and does not express annoyance with wrong response.
- **Interactive Graphics**: Interactive graphics make it possible to sample many more illustrations than could easily be shown in a textbook.
- **Realistic**: Mathematical calculations can be done as readily for realistic examples than can be solved analytically.
• **Accurate:** Large volume of data can be handled with accuracy.

• **Variety:** The novel technique provides enrichment of a course through added variety.

• **Reduced Learning Time:** Interactive technologies reduce learning time. Students can move through the program at their own pace, skipping areas that are familiar with and concentrating on ones in which students are weak.

• **Increased Retention:** Students retain information longer than with passive learning because computer based instruction requires participation of the students.

• **Accessibility:** A computer is available around the clock unlike the teacher.

• **Consistent, Current Content:** Computer assisted instruction equipment does not tire and always delivers content in a consistent and reliable manner. To ensure timeliness and accuracy, the software is updated regularly.

• **Safety:** Students can practice assessment and other clinical skills without jeopardizing a patient.

• **Enhanced Motivation:** Computer based instruction motivates the children to explore new areas of interest and actively seek to broaden the knowledge.

Thus, computer based instruction refers to instruction or remediation presented on a computer. Educational computer programs enhance teacher instruction in many ways. Computer programs can illustrate a concept through animation, sound, and demonstration and in this way, these computer programs are interactive. They allow students to progress at their own pace and work individually or solve problem in a group. Computers programs also provide immediate feedback and letting students to know whether their answer is correct. If the answer is wrong, the program shows students how to correctly answer the question. Computer assisted instruction improves instruction for students with disabilities because students receive immediate feedback and do not continue to practice the wrong skills. In addition, computers capture the students’ attention due to interactive programs and engage the students’ spirit of competitiveness to increase their scores. Also, computer assisted instruction based at the students’ pace and it does not move ahead until students have mastered the skill. Computer programs provide differentiated lessons to challenge students.

The use of computers in education is growing at a rapid rate. One of the main advantages of computer based education is the ability to provide immediate feedback on individual responses. Feedback is any message generated in response to a learner’s action. The most important outcome of feedback is to help learners to identify their errors and
become aware of mistakes. According to Cohen (1985), feedback component is more instructionally powerful feature for further learning (p. 33).

There are two basic characteristics of computer assisted instruction. The first is that the computer can evaluate students’ responses instantly and indicates whether the response is correct or incorrect on the basis of predetermined key words identified within it. When the student’s answers correspond to the anticipated incorrect answers, then the computer gives corrective hints or offers general hints when the answer does not relate to any of the anticipated in correct answers. It would also call for a modified or new answer. In this way, every student is involved in the learning process as different from a conventional classroom where only a small percentage of the students respond to the teacher’s questions. Each student responding and receiving necessary feedback through computer assisted instruction is led towards the goal of effective learning. Secondly, the computer can individualize instruction in a number of specified ways. Instruction can be individualized according to differential aptitude, achievement and interest. The computer makes note of the learner’s performance and progress and on the basis of the evaluation of his ongoing achievement and as per his needs, it can modify his programme for further learning. The great asset of the computer is its instant response and its flexibility to suit the learners’ needs and requirements through tutorial interaction and dialogue (Sharma 2006, p. 499).

“Computer provided feedback would seem to have several advantages. First of all, computers can tirelessly provide feedback in response to student work. This feedback remains accurate, unbiased and nonjudgmental irrespective of student characteristics or the nature of the student response. Thus, computer based feedback can be adapted to the learning styles and needs of each individual student. Attention to feedback is likely to be even more critical in computer based instruction than in traditional classroom instruction because computer based instruction application typically provides a learning environment in which the student works individually having little human interaction. So, the success of computer based instruction depends on the quality and appropriateness of feedback provided to learners rather than what is presented or encountered” (Mason & Bruning, n.d.).

Mathematics self-efficacy was differentiated from self-esteem. Pajares (2002) differentiated self-efficacy and self-esteem (or self-concept). He found self-esteem instead pertains to the evaluation of self-worth which depends on how well one's behavior matches personal standards of worthiness and how the culture values the attributes one possesses. Bandura (2006) found self-efficacy predictive of future academic success. According to
Hackett and Betz (1989), “Mathematics self-efficacy is a situational or problem-specific assessment of an individuals’ confidence in her or his ability to successfully perform or accomplish a particular mathematical task or problem”. Self-efficacy for performance in mathematics tasks has been operationalized in mathematics as a score in the measure of individuals’ self-beliefs about the capacity of performance in some particular aspect of mathematics (Pajares & Miller, 1995). Mathematics self-efficacy is a critical factor in career choice (Kennedy, 1996). According to Bandura (1997), “Perceived self-efficacy beliefs contribute independently to intellectual performance”. According to Collins (1982), “Children who had stronger self-efficacy beliefs were quicker to discard faulty strategies, chose to rework problems they missed, solved more problems and did so more accurately than children of equal ability who doubted their self-efficacy”.

According to Pajares (1996), “Mathematics self-efficacy of college undergraduates was a better predictor of their mathematics interest and majors than either their prior math achievement or math outcome expectations”. Academic self-efficacy influenced achievement directly as well as indirectly by raising students’ grade goals (Zimmerman, Bandura & Martinez-Pons, 1992). Students who believe in their capability of performing academic tasks use more cognitive and meta cognitive strategies and persist longer than those who do not believe in their capability of performing tasks (Pintrich & Garcia, 1991).

Mathematics anxiety was first defined by Dreger and Aiken (1957) as emotional reactions syndrome displayed towards mathematics and arithmetic (Baloglu, 2001). Richardson and Suinn (1972) defined mathematics anxiety as involving “… 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”.

Mathematics anxiety is an irrational and impeditive dread of mathematics (Lazarus, 1974). According to Mathison (1977), “Mathematics anxiety is an irrational fear of mathematics that can range from a simple discomfort associated with numerical operations to a total avoidance of mathematics and mathematics classes”. Mathematics anxiety is defined as a tense and anxious feeling which may obstruct one from manipulating numbers and/or solving mathematical problems (Tobias, 1978). Mathematics anxiety is defined as a term “to describe the panic, helplessness, paralysis and mental disorganization that arises among some people when they are required to solve a mathematical problem” (Tobias & Weissbrod, 1980). Mathematics anxiety is a panic state which keeps one’s thoughts under control (Buxton, 1981). Mathematics anxiety is not innate. People do not have mathematics anxious before
going to school (Williams, 1988). Morris (1981) defined mathematics anxiety as a phenomenon which is one’s illogical fear that when one thinks of mathematics. This fear causes one to freeze up, prevents one’s learning and performance, and causes distress. Mathematics anxiety is “an emotion that blocks a person’s reasoning ability when confronted with a mathematical situation” (Spicer 2004, p. 1). Math anxiety is defined as a feeling of apprehension, tension or fear that interferes with math performance (Ashcraft, 2002).

NEED AND SIGNIFICANCE OF THE STUDY

Mathematics anxiety among students has risen in the last few years. Mostly students avoid mathematics and decide on their program of study based on the math courses needed to complete the degree requirement. Mathematics anxiety is not an intellectual problem but an emotional problem, which can be overcome. Overcoming their fear of mathematics is necessary for the student to be able to become successful in mathematics courses. 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. Efficacy beliefs predict how much fear arousal they experience and how well people cope with threats. Even when the effects of anxiety are controlled, self-efficacy will retain predictiveness of performance, whereas the effect of anxiety should dissipate when self-efficacy percepts are controlled (Bandura, 1986).

According to Isman (2005), “The education and technology play an important role in the education of humans. The education and technology are two different concepts but the use of both resulted in the emergence of a new discipline called the educational technology. Educational technology makes the teaching and learning activities more enjoyable. Students learn by playing and enjoying these activities”.

“Computer attracts students very much. The use of the audio-visual devices, presentations and animations with instructional materials results in the enjoyable and productive learning process. So, the learning process can become enjoyable and interesting for students as a result of abolishing traditional classroom learning activities. Technological developments give rise to new teaching and learning facilities. Educational technology especially computers play an important role in concretizing abstract concepts, which are difficult for children to learn by means of animations” (Akpinar, 2005).
“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). “The use of computer based education increases students’ attitudes and achievements significantly” (Berger, Lu, Belzer & Voss, 1994; Geban, 1995). 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).

The study aims to test the effects of the use of computer based instruction technology is thought to be important which triggers active participation and enables students to make their own meaning. At present, it has been observed that classroom instructions have become too aversive, too negative and improperly sequenced. Thus flexibility in instructional strategy is needed so that students’ can work at their own speed and participate actively in the learning process.

A revolution is taking place in education. The technology transforms education from faulty centered to learner centered and making instructions better by replacing the “sage on the stage” with interactive individualized learning possibilities. One of the technological revolutions is the use of computers. It is ought to be emphasized that the role of computers in curriculum based on realization of their unique attributes has a large importance in education.

Keeping in view the review of researches, it is observed that factors like mathematics self-efficacy and mathematics anxiety affect the achievement in one way or the other way. Therefore, the investigator tried to study the effect of computer based instruction on achievement in mathematics in relation to mathematics self-efficacy and mathematics anxiety. Number of studies has been conducted with students at middle school level regarding mathematics achievement but fewer have focused on individual differences like mathematics
self-efficacy and mathematics anxiety. This also fascinated the investigator to explore this area to find out the relevance of computer based instruction in relation to mathematics self-efficacy and mathematics anxiety.

The aim of mathematics education is not to load the students’ with knowledge but to contribute to their mental development also. Therefore, content and methodology of mathematics teaching should be organized and systematic in such a way that leads to high achievement in mathematics. Anyone can be mathematician. Any person with average intelligence can master the science of mathematics with proper guidance and training (Devi, 2002).

STATEMENT OF THE PROBLEM
EFFECT OF COMPUTER BASED INSTRUCTION ON ACHIEVEMENT IN MATHEMATICS IN RELATION TO MATHEMATICS SELF-EFFICACY AND MATHEMATICS ANXIETY

OPERATIONAL DEFINITION OF THE VARIABLES
(i) Computer Based Instruction: Computer based instruction can be simply defined as the delivery of information with the help of computer. It can be further explained as “the use of a computer to argument classroom, providing instruction and course content in the form of drill and practice, exercise and tutorials”.

(ii) Traditional Method of Teaching: Traditional lecture is an exposition of knowledge, facts, principles or other information which a teacher wishes to present to his pupils. While using this method, the teacher assumes that students possess sufficient background and ability to understand the lecture.

(iii) Achievement: Achievement means performance in a particular subject area or courses, usually by reason of skills, hard work and interest summarized in various types of marks, grades or scores. The achievement test is an investigator made test. It involves the set of questions from selected units of mathematics for 9th class students.

(iv) Mathematics Self-Efficacy: Mathematics self-efficacy is assessed as individuals' judgments of their capabilities to perform math-related tasks, to solve specific math problems or succeed in math-related courses.

(v) Mathematics Anxiety: Mathematics anxiety refers to a state of uneasiness and distress about mathematics and the taking of mathematics tests.
DELIMITATIONS

The study was delimited with respect to the following aspects:

(i) The intelligence of students was assessed with respect to general mental ability test because this is the most important factor affecting achievement.

(ii) The study was confined to 9th class mathematics students of English medium schools from Jalandhar city affiliated to Punjab School Education Board, Mohali.

(iii) Fifteen lessons based on computer based instruction and traditional method of teaching were prepared in mathematics only.

(iv) The students were taken from four high senior secondary schools of Jalandhar city.

(v) The study was confined to two classifying variables i.e. mathematics self-efficacy and mathematics anxiety.

OBJECTIVES

The study was conducted on the basis of following objectives:

1. To develop the mathematics self-efficacy scale.
2. To develop computer based instructional material for selected units of mathematics.
3. To develop a criterion test in mathematics for selected units of mathematics.
4. To develop an achievement test in mathematics for selected units of mathematics.
5. To compare the achievement of group taught through computer based instruction and conventional group in mathematics.
6. To compare the achievement of high and low groups of students on mathematics self-efficacy.
7. To compare the achievement of high, average and low groups of students on mathematics anxiety.
8. To examine the interaction effect of instructional strategies and mathematics self-efficacy.
9. To study the interaction effect of instructional strategies and mathematics anxiety.
10. To find out the interaction effect of mathematics self-efficacy and mathematics anxiety.
11. To examine the interaction effect among instructional strategies, mathematics self-efficacy and mathematics anxiety.

HYPOTHESES

The study was designed to test the following hypotheses in the study:

H₀: The achievement of group taught through computer based instruction is significantly higher than that of conventional group in mathematics.
H₂O: The achievement of high mathematics self-efficacy group is significantly higher than that of low mathematics self-efficacy group of students in mathematics.

H₃O: The achievement of low mathematics anxiety group is significantly higher than that of average and high mathematics anxiety group of students in mathematics.

H₄O: There exists no significant interaction effect of instructional strategies and mathematics self-efficacy.

H₅O: There exists no significant interaction effect of instructional strategies and mathematics anxiety.

H₆O: There exists no significant interaction effect of mathematics self-efficacy and mathematics anxiety.

H₇O: There exists no significant interaction effect among instructional strategies, mathematics self-efficacy and mathematics anxiety.

SAMPLE
The sample in the present study was drawn at the school and student level. The schools were drawn randomly from list of senior secondary schools of Jalandhar affiliated to Punjab School Education Board, Mohali. A list of the schools under the administration of Jalandhar was procured from District Education Officer. The schools were compared with regards to the criteria that the schools have almost class climate, physical facilities, computer labs etc. The list of four schools taken for the study is given below:

(i) Government Girls Senior Secondary School, Nehru Garden, Jalandhar
(ii) Government Model Co-Edu Senior Secondary School, Ladowali Road, Jalandhar
(iii) Government Model Senior Secondary School, Ladowali Road, Jalandhar
(iv) Doaba Khalsa Model Senior Secondary School, Jalandhar

After selecting schools, the intact sections of each school were randomly taken for experimental and control group. The present study was conducted on initial sample of 400 students of 9th class of English medium schools from Jalandhar city affiliated to Punjab School Education Board, Mohali. A list of schools was collected from District Education Officer, Jalandhar. Out of total schools of Jalandhar city, four schools were randomly selected. After selecting the schools the student sample was drawn randomly. Thus, the initial sample consisted of 400 students. After classifying on the variables of mathematics self-efficacy and mathematics anxiety, the final sample consisted of 216 students.
DESIGN

The present study was designed to study “Effect of computer based instruction on achievement in mathematics in relation to mathematics self-efficacy and mathematics anxiety”. The present study was experimental in nature. A pre-test and post-test was employed. In order to analyze the data, 2×2×3 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 study covered three independent variable such as instructional treatment, mathematics self-efficacy and mathematics anxiety. The variable of instructional treatment was studied at two levels, namely computer based instruction and traditional method of teaching. The variable of mathematics self-efficacy was studied at two levels such as high and low mathematics self-efficacy. 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 collecting data:

(i) General Mental Ability Test (1972) by Jalota was used to assess the intelligence of the students for matching the groups.

(ii) A Criterion Referenced Test in Mathematics was developed by investigator herself.

(iii) An Achievement Test in Mathematics was developed by investigator herself.

(iv) Computer Based Instructional Material in Mathematics (through multimedia CD’s, power point presentation) was developed by investigator herself.

(v) Instructional Material in Mathematics based on traditional method of teaching was developed by investigator herself.

(vi) Mathematics Self-Efficacy Scale was developed by investigator herself.

(vii) Mathematics Anxiety Scale by Karimi and Venkatesan (2011) was used.

PROCEDURE

After the selection of sample and allocation of students in two groups for two instructional strategies, the experiment was conducted in six phases:

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Firstly, the investigator made necessary arrangements with the Principals of the school selected for the experiment. Secondly, general mental ability test to assess intelligence was administered for matching of the students. Thirdly, mathematics self-efficacy scale and mathematics anxiety scale were administered for the classification of the students. Fourthly, achievement test as a pre-test was administered to the students of experimental and control group. The students were given 45 minutes to complete the test. The answer-sheets were scored to obtain the information regarding the previous knowledge of the students. Fifthly, treatment was given to the experimental group. The experimental group was taught through computer based instruction. Fifteen 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 herself. The duration of instructional treatment was 20 sessions in each group and time for each session was 40 minutes. Sixthly, after the completion of the course, same achievement test was administered simultaneously as post-test to the students of both the groups. Time limit for the test was 45 minutes. The answer-sheets were scored with the help of scoring key. The scores obtained comprised the post test scores. After the completion of test, students were thanked for their full cooperation. Experimental and control group scores were compared according to their pre and post-test scores. The difference was called gain achievement scores.

**STATISTICAL TECHNIQUES USED**

Statistical techniques were employed to give the concise picture to the data so that data can be easily comprehended. The following statistical techniques were used to test the hypotheses:

(i) Descriptive statistics techniques like mean, standard deviation, skewness and kurtosis were used to see the nature of distribution of the scores.

(ii) A three way Analysis of Variance (2×2×3) was employed on the gain achievement scores to test the hypotheses related to the strategies of teaching, mathematics self-efficacy and mathematics anxiety.

(iii) For the significant F-ratio, the t-test was employed so as to find out the significance of difference between means related to different groups and different variables.

(iv) Graphical techniques were used for descriptive analysis and visual perception of the data.
FINDINGS

(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 high mathematics self-efficacy group was found significantly higher than that of low mathematics self-efficacy group of students in mathematics.

(iii) The achievement of students with different mathematics anxiety was found significantly different from one another in mathematics. Further analysis revealed that:
  - The mean gain achievement scores were found significantly higher on high and average mathematics anxiety groups.
  - The mean gain achievement scores were found significantly higher on high and low mathematics anxiety groups.
  - The mean gain achievement scores were not found significant on average and low mathematics anxiety groups.

(iv) There was significant interaction effect of instructional strategies and mathematics self-efficacy on achievement in mathematics. Further analysis revealed that:
  - The high mathematics self-efficacy of experimental group exhibited higher mean gain scores than that of low mathematics self-efficacy of experimental group.
  - The high mathematics self-efficacy of experimental group exhibited higher mean gain scores than that of high and low mathematics self-efficacy of control group.
  - The low mathematics self-efficacy of experimental group exhibited higher mean gain scores than that of low mathematics self-efficacy of control group.
  - Rest of the combinations of instructional strategies and mathematics self-efficacy group did not yield significant difference in mean gain achievement scores.

(v) There was significant interaction effect of instructional strategies and mathematics anxiety on achievement in mathematics. Further analysis revealed that:
  - The low mathematics anxiety of experimental group exhibited higher mean gain scores than that of high and average mathematics anxiety of experimental group.
  - The average mathematics anxiety of experimental group exhibited higher mean gain scores than that of high mathematics anxiety of experimental group.
  - The average mathematics anxiety of experimental group exhibited higher mean gain scores than that of high, average and low mathematics anxiety of control group.
• The low mathematics anxiety of experimental group exhibited higher mean gain scores than that of high, average and low mathematics anxiety of control group.
• The average mathematics anxiety of control group exhibited higher mean gain scores than that of high mathematics anxiety of control group.
• The low mathematics anxiety of control group exhibited higher mean gain scores than that of high mathematics anxiety of control group.
• Rest of the combinations of instructional strategies and mathematics anxiety group did not yield significant difference in mean gain achievement scores.

(vi) There was no significant interaction effect of mathematics self-efficacy and mathematics anxiety on achievement in mathematics.

(vii) There was no significant interaction effect among instructional strategies, mathematics self-efficacy and mathematics anxiety on achievement in mathematics.

EDUCATIONAL IMPLICATIONS OF THE FINDINGS

The present study has wide applications in education which are as follows:

(i) 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.

(ii) In-service teachers can be given computer literacy through refresher courses so that those who are not computer literate can take benefit of this.

(iii) Government should step forward to provide more computers to government as well as to private schools at low cost.

(iv) Computer labs should remain open all the time so that students during their free period can have access to the labs.

(v) Teachers should be trained to select the computer based instructional packages from various websites and open sources. The teachers can further help the students to select the computer based instructional packages to assist them in effective learning. Parents can also be educated about the importance of selecting these computer based instructional packages.

(vi) Teachers should use innovative methods to stimulate the attention and sustain the interest of students in mathematics. So that students’ self-efficacy beliefs to do mathematics can be improved.
(vii) Teachers and parents must have a positive attitude towards mathematics to reduce mathematics anxiety among students as teachers and parents’ attitude towards mathematics has marked influence on students’ mathematics anxiety.

(viii) As there was significant interaction effect found between computer based instruction and mathematics anxiety, the teachers can use computers as supplement in their teaching learning process to reduce mathematics anxiety among students.

(ix) The teachers can use computer based instruction to improve mathematics self-efficacy of students as the interaction effect have been found between computer based instruction and mathematics self-efficacy.

SUGGESTIONS FOR FURTHER RESEARCH

The following suggestions are for undertaking further studies in the area:

(i) The present study was confined to teaching of mathematics. So, it can be conducted to determine the effect of computer based instruction for other teaching subjects.

(ii) The present study can be conducted on other levels of classes.

(iii) The study can be conducted to investigate the effectiveness of computer based instruction on the basis of gender.

(iv) Research can be conducted to investigate the effectiveness of computer based instruction in relation to other variables like attitude, interest.

(v) These methods may be much beneficial for students with special needs.